Chemical Age

NEW MARKETS NEEDED FOR U.K. CHEMICALS

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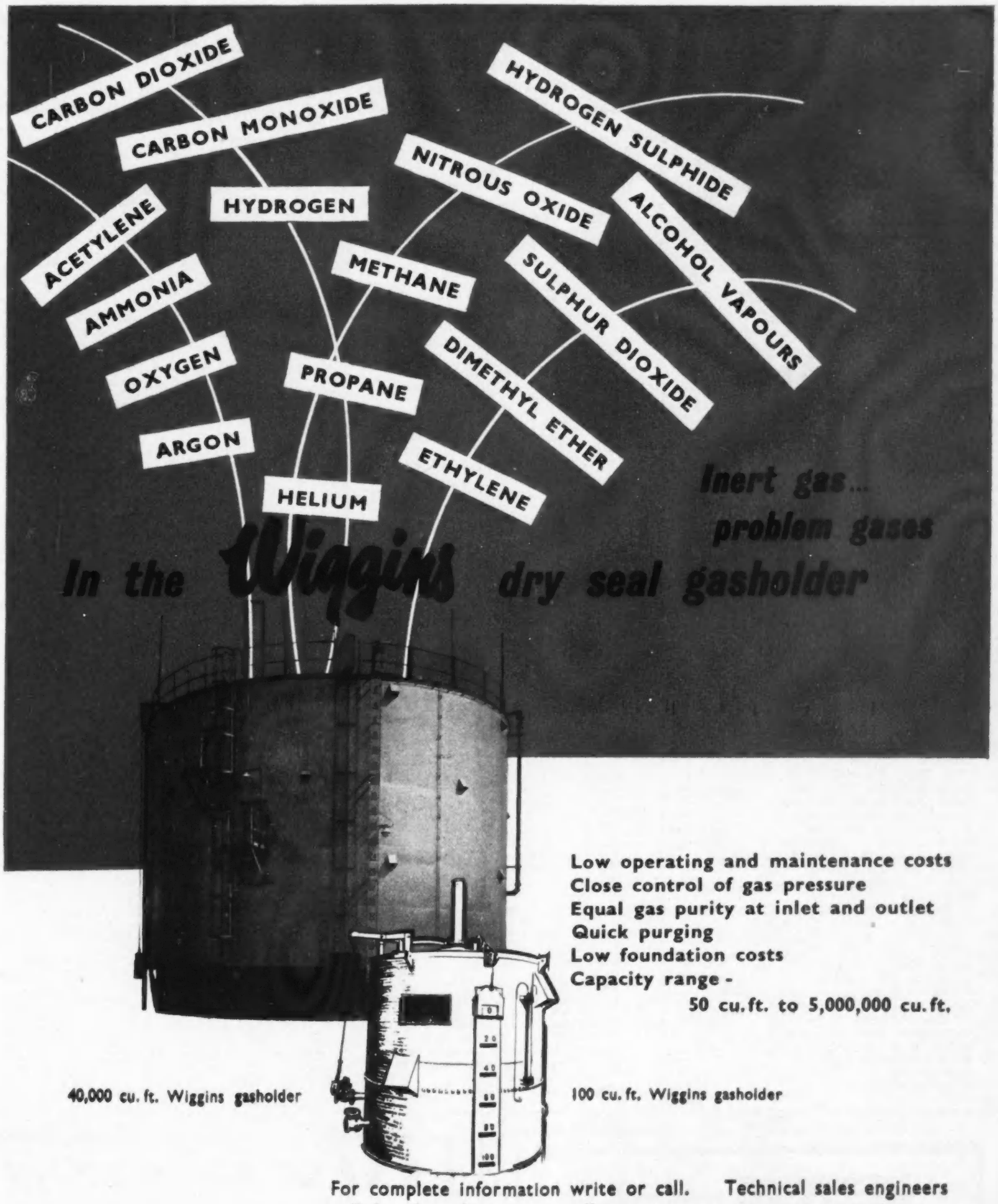
VOL. 81 No. 2071

21 March 1959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OXYGEN
PROPANE
DIMETHYL ETHER
ARGON
ETHYLENE
HELIUM
Inert gas...
problem gases
In the Wiggins dry seal gasholder

INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age Directory & Who's Who,** *the second to the current issue*

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VOL. 81 No. 2071
MARCH 21 1959

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IN THIS ISSUE

Annual subscription is: home, 52s 6d, overseas, 60s, single copies 1s 6d (by post 1s 9d)

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CHEMICAL AGE

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EASTWARD HO?

HAS the Prime Minister's recent visit to the U.S.S.R. started off a new train of thought on trade with the iron curtain countries, or are the internal murmurings of British industry now coming to light? Mr. Macmillan in his Moscow talks indicated that the U.K. desired trade as it was our means of livelihood. Concern for our trade prospects has been voiced, for Britain's export figures are showing a declining percentage of world trade. But in one sector, that of the chemical industry, the increase in chemical exports as a proportion of our total exports has been a little greater than for the world as a whole. (British exports of chemicals represent 9.3% of total British exports compared with 11.2% of total exports for the world as a whole.)

O.E.E.C. reports have shown that the largest market for the import of chemicals is Continental Europe, including the U.K., but that two of the smallest importing areas are the British overseas territories and the rest of the sterling area. Examination of British chemical exports shows that these are going to the small markets which are not expanding rapidly. It has been West Germany and the U.S. who have supplied the greater part of Europe's imports of chemicals (26.2% and 19.8% respectively as against the U.K.'s 10.7%.

International competition in the chemical industry was discussed by Mr. S. P. Chambers, deputy chairman, I.C.I., in the 10th annual lecture of the Plastics Institute last week (see p. 497). In a masterly survey he pin-points the problems facing British chemical industry today and endeavours to suggest a solution. As deputy chairman of one of the world's largest chemical concerns, his remarks must bear considerable weight. Of particular interest therefore is his suggestion that Britain should aim, if possible "at a substantial expansion of exports to countries behind the iron curtain because of the growing needs of their capital and consumer industries; and increased exports to all those miscellaneous markets which lie outside the U.S., Western Europe and the sterling area."

British chemical industry has never been keen on the North American market, for apart from the costliness of export ventures in the U.S. or Canada, due to the need for heavy advertising and expensive representation, U.S. policy of protection has proved, to say the least, very difficult indeed. Speciality products can prove successful in this market, but usually it means that a tie-up is necessary with a U.S. company. If U.S. demand is being satisfied by imports from the U.K. or elsewhere, U.S. business concerns seek Government help for protection in the form of tariffs or the imposition of restrictive import procedures. Canada, too, is affected by the American way of life. On the U.S. doorstep, the country has always been flooded with U.S. advertising, and sales literature, etc. The U.K. exporters have found it a costly manner to put over their products in Canada.

The trend has been, therefore, for British chemical exporters to look to the overseas sterling areas, but the intake of chemicals by these areas is not expanding at the same rate as the more industrialised countries, particularly West Europe. Chambers remarked that if he were asked which of the market areas for British goods was the most satisfactory from all points of

view, he would pick on Western Europe, since trade between industrialised countries tended to be more evenly balanced. Unless progress is made either with a Free Trade Area of which Britain and the European Economic Community are parts, however, British trade with Continental Europe will become more difficult and could even decline. Unfortunately, too, the sterling area is not viewed hopefully because here Britain is likely to meet with strong competition from countries behind the iron curtain.

Up to the present the U.K. has been more concerned with the growing competition from West Germany and Japan, but Chambers indicates that competition from the U.S.S.R. and China may be the most serious problem in the future. Recently India and South Africa have been the areas for sales of chemicals from countries behind the iron curtain. The quantities now being sold, although relatively small, are mounting and cannot be disregarded.

Overall a more hopeful view is suggested by Chambers. Russia and China's standards of living must rise with increased industrialisation and will bring with it a growing demand to import products, including chemicals, either not manufactured or not produced in sufficient quantities.

There is, too, the prospect that different classes of chemicals will be required. At present, trade in certain chemicals is expanding at a greater rate than others, notable examples being plastics and the products of the pharmaceutical industry. The U.K. export figures show that compared with the world as a whole, plastics exports represent a larger proportion of our chemical exports than it does for the world as a whole. Similarly pharmaceutical exports represent 15.8% of our total exports. The distribution of British exports between different products is more favourable, states Chambers, in the sense that we have larger proportions of those chemicals in which world trade is likely to expand. Over the last 18 months, there has been a relaxation in chemicals exports to the U.S.S.R. The U.K. lifted the embargo imposed on certain chemicals, for export to Russia, China and the Soviet Bloc. The U.S. followed suit to some extent. But while there has been news of sales of British plant and equipment to Russia, Poland and other iron curtain countries, U.S. chemical and allied industries, presumably taking their lead from the U.S. Government, have been declining to trade with Russia (see Distillates last week).

That there is an opening for more trade with Soviet Eastern Europe has not gone unnoticed in West Germany. Distribution of the exports of plastics by the U.K., U.S. and West Germany, shows that while the U.K. supplies the major part of the import requirements of the sterling areas and the U.S. dominates the North and South American markets, Germany has already 27.1% of the West European market, the largest in the free-world, and the greatest share in the as yet small but growing markets of Soviet Eastern Europe.

PENICILLIN NUCLEUS

ISOLATION of the penicillin nucleus, 6-amino-penicillanic acid is considered in an editorial in the current issue of the *British Medical Journal* (1957, *i*, 702). It emphasises that the report by Rolinson, Doyle *et al.* (see CHEMICAL AGE last week) must rank as the first acceptable publication of the isolation of 6-amino-penicillanic acid from a natural source. Reference is made, however, to a report that J. C. Sheehan, Professor of Chemistry, Massachussets Institute of Technology, who is retained by Merck Inc. and Bristol-Myers, has synthesised the penicillin nucleus (' Amino Acids and Peptides with Antimetabolic Activity ', 1958, p. 258). Several people have, of course, suggested the formula for 6-amino-penicillanic acid among them Burger and some Japanese workers, but there has been no suggestion until now that the compound had been isolated. Sheehan will be reading a paper at the A.C.S. Boston meeting shortly and more news of his work may be gleaned then. The *New York Herald Tribune* referring to the Beecham research mentions that Sheehan has found an interesting product from some 12 that he has had under investigation during the last two years.

From comments made in the *B.M.J.* it would seem that the writer feels some doubts about the value of coupling on what may be considered appropriate side chains to the normal penicillin nucleus. It is pointed out that to date one antibiotic has been found which is related to the penicillin family—Cephalosporin C, but that is insensitive to penicillinase. This unusual property is owed, it is indicated, not to a modification in the side chain but in the nucleus (Abraham E. P., and Newton, G. C. F., *Biochem S.*, 1954, **58**, 103, and ' Amino Acids and Peptides with Antimetabolic Activity,' 1958, p. 205). Cephalosporin C, although having a low antibacterial activity, in adequate doses protects mice from infection with a penicllinase-producing strain of *Stap. aureus*, and it has been suggested by Abraham ('Biochemistry of Some Peptide and Steroid Antibiotics', 1957) that there is a possibility of obtaining more valuable compounds with a similar nucleus.

Cephalosporin C is known to have the penicillin nucleus plus some other group. It is within the realms of possibility that Abraham has gone considerably further in his identification of the structure of this compound, but that the work is still unpublished.

Cephalosporin C would not be economic to produce in quantity at this stage. It is produced by fermentation but considerable work would be involved in obtaining better yields. Production of the penicillin nucleus by fermentation rather than by synthesis is considered to be economic and of practical value, particularly as antibiotic manufacturers are so well versed in penicillin fermentation techniques and have the necessary plant and equipment available. Whether modifying the side-chain will produce penicillins with the desired properties (see CHEMICAL AGE last week) remains to be seen. As patents have been applied for since 1957 by Beecham Research Laboratories, it seems that the company have a shrewd idea of the field open to them. Nevertheless, more is likely to be heard from the school which believes that modifications of the penicillin nucleus will lead to valuable new penicillins.

REVISED METHANE COSTS

SOME interesting revised costs for liquefaction and ocean transports of natural gas were given by a natural gas expert, Lajos Von Szeszich, Air Products Inc., at the recent International Convention on Hydrocarbons in Piacenza, Italy. The figures quoted were for cascade-cycle plant, and assume 30% efficiency for power generation, and fuel requirements of 15.8% per cent of the methane liquefied.

Szeszich quoted figures of $300 to $400 Mscf. capacity for investment costs of natural gas liquefaction plants, compared with $196 to $242 stated in the literature. These figures are for a plant which receives natural gas at 600 p.s.i.g. and reliquefies boil-off from storage. Liquefied gas storage costs are put at $6-$17 Mscf., for single-tank storage volumes of not less than about 19,000 cu. ft. Plant operating costs are about 8.5c to 10.5c/Mscf., including storage and loading cost, but not raw material or fuel costs, depreciation or return on investment.

With regard to transporting liquid methane by sea, Szeszich reports that for ships built in non-American shipyards the cost is of the order of $700 to $850/ton of methane carrying capacity, for ships of 10,000 to 25,000-ton capacity. Parallel costs for propane, butane and LPG are considerably lower.

U.K. Chemical Makers Urged to seek New Markets in Communist-bloc Countries

I.C.I. Deputy Chairman on Shrinkage of Traditional Markets

BRITAIN faces a more difficult future as a chemical exporting nation than other major chemical producing countries, declared Mr. S. P. Chambers, a deputy-chairman of Imperial Chemical Industries Ltd., last week. He thought that British chemical industry would have to shift the emphasis from its present main markets to other areas, in particular to the iron curtain countries.

In a survey of international competition in the chemical industry, presented as the tenth annual lecture of the Plastics Institute on 12 March, Mr. Chambers saw the main problems facing Britain as threefold.

First: Britain would be increasingly excluded from Europe, the world's largest market for chemicals which now takes one-third of the free world chemical exports and which is expanding fast. Second: Any success in exporting to the U.S. was likely to be countered with higher tariffs. Third: This country's main markets, now largely in the Commonwealth, were susceptible to periodic import barriers due to balance of payment problems; also those markets were the most likely targets for Communist-bloc chemical exports.

However, the picture was not all gloomy, for in certain fields, notably pharmaceuticals and plastics, Britain's performance was better than that of some of her main competitors.

In 1954, although U.K. production of chemicals was 8.9% of the world figure, British exports amounted to 15.9% of world exports. The U.S., with 52% of world output, had 28% of the exports, while West Germany with 7% of output had 16.9% of exports.

Industrialised Countries

Between 1952 and 1956, exports of chemicals to the world's industrialised areas rose from 49% to 52%, while exports to non-industrialised areas fell from 51% to 48%. In 1956, only 36% of U.K. chemical exports went to industrialised countries, while for West Germany the figure was 66%, for Switzerland 60% and France 45%.

The largest importing chemical area was Continental Europe, including the U.K.; two of the smallest importing areas were the British overseas territories and the rest of the sterling area, which roughly covered the self-governing countries of the Commonwealth. While between 1952 and 1957, Europe's intake of chemicals increased by no less than 95% in value, the intake by British overseas territories had risen 29% and the rest of the sterling area, by 70%. Intake of chemicals by North America had risen by 27% in the same period.

In 1957, chemicals accounted for 52.3% of the imports of British overseas territories and 46.7% of imports of the rest of the sterling area. While Britain supplied only 10.7% of Europe's imports of chemicals, West Germany supplied 26.2% and the U.S. 19.8%. North and South American markets were supplied mainly by the U.S., but even here the proportion supplied by West Germany was higher than that of the U.K.

Of the U.K's total chemical exports in 1952, 19.5% went to Continental

S. P. Chambers, whose analysis of Britain's export trade was given as the annual lecture of the Plastics Institute

Europe, 18.7% to British overseas territories and 31.9% to other sterling area countries. In 1956, the proportion of British chemical exports going to Europe went up to 25.2%; the proportion going to sterling area countries was more static.

While the U.S. as a market, at first sight appeared to be rich and reliable the penalty for too much success in selling there might be a very severe one indeed with tariff protection or the obstruction of imports by excessively complicated and onerous customs procedures.

Britain's main markets—the two overseas sterling areas—were not expanding their intake of chemicals at the same rate as the more industrialised countries and were not reliable markets because a sharp fall in the price of wool could well lead to a restriction of imports by Australia or New Zealand. In addition those countries were beginning to establish industries of their own.

Mr. Chambers said that West Europe was the most satisfactory of the market

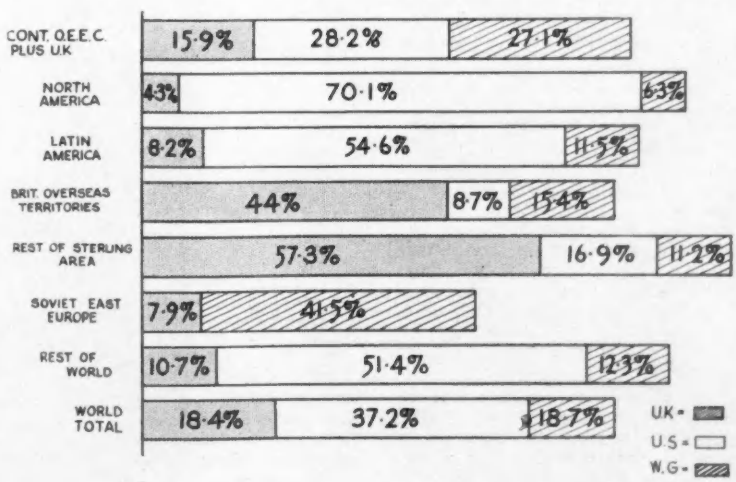
U.K. and Major Competitors' Percentage Share of World Chemical Exports

	1952	1954	1956	1957
U.K.	18.2	15.9	15.4	15.1
U.S.	29.1	28.0	28.4	28.3
West Germany	12.7	16.9	17.5	18.2
France	10.2	9.4	8.3	8.4
Switzerland	5.2	5.8	5.3	5.2
Canada	5.3	5.6	6.1	4.9
Japan	1.4	2.2	2.4	2.5

areas from all points of view. Trade between industrialised countries tended to be more evenly balanced and less likely to be affected by the fortunes of particular products, or balance of payments crises, or sudden policy changes. Unfortunately, the position in West Europe was clouded by the shadow of the Common Market with the U.K. on the outside.

If because of developments in Europe and tariff policy in North America, we were thrown back on the sterling areas as our main market, then further trouble was in prospect. Mr. Chambers thought we could expect increasing competition from Russia and China, both of whom had been increasing their chemical ex-

U.K., U.S. and West German Share of World's Plastics Exports in 1956



Free World Chemical Exports to Market Areas

Market Area	Total Exports 1956 £m	1957 £m	1956 %	1957 %	Increase in Value from 1952 1956	1957
Cont. O.E.E.C. plus U.K.	569	638	35.9	36.2	74	95
North America	206	193	13.0	11.0	35	27
Latin America	214	254	13.5	14.4	33	57
British Overseas Territories	62	72	3.9	4.1	11	29
Other Sterling Area	161	183	10.2	10.4	36	70
Soviet Eastern Europe	29	40	1.9	2.3	52	105
Rest of World	342	382	12.6	21.7	85	108
Total	1,583	1,762	100.0	100.0	57	75

ports. Countries like India and South Africa could not be expected to erect obstacles to the import of low-priced chemicals from iron curtain countries for the benefit of British industry. In that respect U.K. markets were more vulnerable than the internal markets of the U.S. producers or the European markets of West Germany.

He thought that an investigation of the facts might show that costs of production in Russia and China were lower than in Britain and that their exports were not so uneconomic as some would like to believe.

He thought the U.K. could expect intermittent floods of chemicals from those countries. In India for instance, the appearance of large quantities of soda ash from China in one year, but not in the next, indicated that there might be capacity in China which had an exportable surplus from time to time. There was not much protection from that competition. It was possible that those export surpluses could be used in planned economic warfare, but he felt it better to assume that they were not planned and that they were used for purely economic purposes such as the means by which foreign exchange could be earned.

As standards of living rose in Russia and China, and their industries become more complex there would probably be a growing demand to import chemicals.

Importance of Plastics

Britain could also derive some comfort from the fact that plastics, the expanding export group, represented a larger proportion of Britain's chemical exports than they did for the world as a whole. In the rapidly growing field of plastics, British exports to Europe were proportionately greater than British exports to Europe of chemicals as a whole. Britain accounted for 10.7% of Europe's imports of chemicals in 1956; for plastics the figure was 15.9%. West Germany accounted for 54.1% of Europe's imports of chemicals, but only 27.1% of plastics.

Pharmaceuticals were likely to continue to figure largely in world trade because of the demand for new drugs and the difficulty of setting up local manufacture. The export of U.K. drugs represented 15.8% of our total exports, but only 8.8% of West German exports.

Britain had been depending too much on the overseas sterling area for its markets and he thought that Britain should aim at a substantial expansion of exports to countries behind the iron curtain because of the growing needs of their capital and consumption industries. This country should also aim to increase exports to all those markets outside the U.S., West Europe and the sterling area, which could become important and provide a good insurance against the hazards of our present major markets.

C.A. Reprints on Polymer Tribunal

The exclusive *Chemical Age* 2-page report of the Polymer Arbitration Tribunal, has been reprinted. This report is the only one apart from the official proceedings of the case and it appeared in our issues of 15, 22 and 29 November and 6 December. Readers who have not applied for copies of this important reprint should do so as soon as possible by writing to the Editor, *Chemical Age*, 154 Fleet Street, London E.C.4. Copies are priced at 2s. 6d. each, including postage.

Pfizer's New Polio Vaccine was an All-British Development

THE new British poliomyelitis vaccine introduced by Pfizer Ltd., Sandwich, Kent, will, it is hoped, be considerably more potent than any at present on the market. That is the aim of the company and Mr. Richard C. Fenton, chairman, last week declared "We may well have a statement to make on this in a few months."

The decision to make the vaccine was taken by the company independently of the U.S. parent, Chas. Pfizer, who were also working on a similar project. In fact the British team was able to announce its new polio vaccine a few weeks ahead of the American concern.

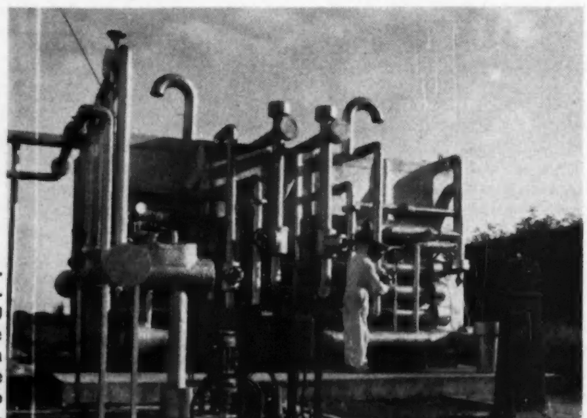
The Ministry of Health has now released the test batch of 163,000 doses and other batches are at different stages of production. Some 2,000,000 doses are now ready for testing. Production at the Pfizer plant at present is for 10 million doses a year, but capacity is such that this figure can be doubled. There will in due course be sufficient British vaccine to provide immunisation for everyone up to 40, without the need for imports.

Decision to produce the vaccine was made in September 1957 and ground on the site was broken a month later. The first building of about 10,000 sq. ft. containing more than 100 separate rooms, with air conditioning, sterile areas and many other complex systems, was delivered by the contractors in December 1957—11 weeks after work was started. The whole plant was finished by mid-February 1958.

Mr. Fenton stressed that the production process and the stringent potency and safety testing procedures had been developed by the company's own British team in its own British plant. They had, however, benefited from interchange of data with the American staff.

Taking everything into account, the venture had cost the company about £1 million. Pfizer do not expect to make a profit out of polio vaccine, but the plant can be used later to produce other vaccines.

It had been decided to enter the vaccine field because vaccines "are important for a major pharmaceutical company." Although they chose probably the most difficult vaccine to produce, there was the advantage that the new team had gained its experience under the most testing conditions.



Effluent tank serving the polio vaccine unit. All liquid from the unit is treated in this tank before being allowed into the normal drainage system

5-Year Extension for Terylene Patents

Celanese Plea Rejected—C.P.A. Claim Not Fully Justified

PATENTS on Terylene belonging to the Calico Printers' Association (C.P.A.) have been granted an extension of five years from 13 July 1958. This decision was announced on 13 March by the assistant comptroller of the Patents Division, Mr. H. S. Gilham, following his consideration of the request of the patent holders, and the objectors, British Celanese Co.

C.P.A. had asked for an extension on the grounds that the company had suffered loss and damage because of wartime conditions. Their application was supported by I.C.I. who have a licence from C.P.A. for working the patents in the U.K.

British Celanese's plea that no extension should be granted was rejected by Mr. Gilham, although he found that the full claim by C.P.A. was not justified. He awarded British Celanese 30 guineas costs.

Development of the polymer and its products could be conveniently considered in two stages. The first stage ran from the middle of 1941, when the patent application was made, to the end of 1945 when a decision was taken to test towards development on a commercial scale. The second stage ran from the end of 1945 through the various development stages, up to the beginning of 1955, when the full commercial plant for the production of polymer and fibre came into operation.

Calico Printers' Case

The case offered by C.P.A. was that the development of the invention involved the use of very large resources, but could not, in Mr. Gilham's view, have taken 13½ years from the initial discovery to full commercial production. They had stated that eight years of this period were lost by reason of delays, such as shortages of manpower and materials and the existence of building controls which resulted from the war.

The opponent's case was broadly, that in the first stage, the war had some effect in accelerating development and in the second stage problems and difficulties inherent in the development and exploitation of the polymer and fibre were so serious that progress could not have been quicker even if there were no delays caused by the war.

In his decision Mr. Gilham stated that he felt no doubt that both thought and work had been delayed by the war, but the C.P.A. assessment that three out of the 4½ years of the first stage were lost was considered "rather too optimistic". With regard to the second stage of nine years, C.P.A. had argued that under peacetime conditions all the work could have been completed in four years. Five years, according to C.P.A., were wasted by post-war difficulties, such as delays in getting building licences, shortages of materials, and shortages of technicians and draughtsmen. British Celanese had argued, however, that the commercial development of this new fibre could not have proceeded more quickly, the rate of progress being governed by the difficulties and problems inherent in the project itself, particularly as regards processing of the fibre to meet the requirements of the textile trade and consumers. The opponents had suggested, Mr. Gilham stated, that I.C.I.'s work on Terylene was conditioned by their concentration on another fibre, Ardil, plant for which was announced in 1947 and came into production in 1951.

Assessment of the total delay in the second stage due to post-war conditions was not easy. It was clear from evidence presented by C.P.A. that development in any case required the solution of many new problems inherent in the project itself. A total delay of five years in this stage was claimed by C.P.A. British Celanese had contended that such delays as occurred had given I.C.I. time to solve problems inherent in the project which would have taken as long to solve if there had been no war.

Comparison was made by Mr. Gilham, of the time taken to bring nylon and Orlon to the stage of commercial production. He instanced Dacron, made in the U.S. by E.I. Du Pont de Nemours that under the U.S. Terylene patent took 6½ years to reach the commercial stage. He therefore thought that he could properly draw the conclusions that in the absence of extraneous obstructions 13½ years to reach the commercial stage of Terylene would seem an unreasonably long time for organisations with the resources and experience of C.P.A. and I.C.I. and that the applicant's estimate of 5½ years seemed, in all circumstances, "improbably short". With regard to the Ardil project, that had certainly been a big project, requiring great resources, and "it would be easy to guess that the expenditure of these resources on Ardil must have diverted attention somewhat from Terylene". I.C.I., however, had stated positively that development of Ardil had not interfered with the development of Terylene and Mr. Gilham had no reason to disregard that statement.

Making the best assessment that he could in the light of all the considerations, Mr. Gilham found it reasonable to conclude that the applicants had lost as much as five years' useful enjoyment of their patent. He had therefore decided to extend the main patent and the patent of addition (578,079 and 603,827 respectively) for a period of five years from their date of expiry.

An opportunity has been given for any application against the decision to be heard.

I.C.I. Build New Nitric Acid Plant at Ardeer

WORK on the erection of a nitric acid plant by I.C.I.'s Nobel Division, at Ardeer has started on a site adjacent to the Misk nitrocotton steaming house. Major items of plant have been ordered and it is estimated that a unit will be available for commissioning during the second quarter of 1960. The design chosen is an intermediate oxidation pressure plant.

This was stated recently by Dr. James Craik, division chairman, who also mentioned that major proposals were being considered which would be further steps in the modernisation of acids manufacture.

The new isopropyl nitrate plant at Ardeer is now undergoing production trials.

Laporte H.T.P. Used for Black Knight Firing

High test hydrogen peroxide produced by Laporte Chemicals Ltd., was the oxidant used in the rocket motor of the Black Knight high altitude research rocket, which has had its second successful launching at Woomera, Australia. Laporte are one of the world's leading makers of H.T.P., producing it at their new plant at Warrington by a new organic process of their own development, and in Australia.

Brazil as Market for U.K. Industrial Chemicals

THAT there is a good market for industrial chemicals in Brazil and that the U.K. share of it could be considerably increased if a serious effort were made, are conclusions reached in a Board of Trade report on the survey of the market. It is published by the Export Services Branch, Lacon House, London.

Major chemicals imported in 1957 were sodium hydroxide, valued at U.S. $9,099,293; sodium carbonate ($4,638,320); carbon black ($3,270,236); styrene ($2,023,384); titanium dioxide ($1,549,307); dioctyl phthalate ($1,402,844); sulphonamides and derivatives ($1,258,765); and ureas ($1,183,767).

Among new developments in the sodium hydroxide field are an expansion of capacity by Electro-Cloro in 1960 to 35,000 tons a year and a new plant which the Companhia Nacional de Alcalis plan to bring into production soon with an output of 45,000 tons a year, plus 70,000 tons of sodium carbonate a year.

A methanol plant projected by Alba S.A., near Cubatao, has a planned production target of 15,700 tons annually. Production of hydrogen peroxide, about 450 tons a year, is to be boosted by the opening of a new plant shortly by Companhia Eletroquimica de Osasco with an annual capacity of 700 tons.

★ THE Italian sulphur industry has been greatly interested in the recent statement of the president of the Freeport Sulphur Co. that world consumption of sulphur would increase within the next 25 years to 50 million tons a year, compared with the 16 million tons consumed in 1957. By 1975, the processing of uranium ore is expected to require from 9 to 12 million tons of sulphuric acid extra, while the development of chemical fertilisers in China and India will, it is estimated, call for about another 36 million tons.

This means that an additional 15 or 16 million tons of sulphur will be required yearly.

If demand develops along the lines envisaged, it could help revitalise Sicily's declining sulphur industry. Output has declined each year from the 1952 figure of 214,338 tons to last year's total of 157,580 tons. Stocks at the end of 1952 totalled 99,481 tons, compared with 233,337 tons at the end of 1958.

★ NOW that the Gas Council's and Constock International's *Methane Pioneer* has successfully completed her first voyage carrying liquid methane, she has returned across the Atlantic to pick up another cargo of the liquid gas. Three or four more trial voyages are needed to establish the economic and technical practicability of shipping methane in this fashion.

Seemingly, *Methane Pioneer's* success has encouraged development of a French liquid methane ship which is to be started in April next. Société d'Etude du Transport et de la Vaporisation des Gas Naturels du Sahara (SEGANS) organised by France's Air Liquide and four Sahara oil companies, is carrying out the project. This installation will be at Villeras near Paris.

★ THE Manufacturing Chemists' Association tells me that privately-financed chemical production facilities completed last year in the U.S. cost the record total of $1,775,000 million, compared with the previous best total of $1,300,000 million in 1957. An additional $1,054,000 million is to be spent on projects now underway and $464,090 million for projects scheduled for groundbreaking in the near future and completion before 1961. This will bring total chemical plant construction to an estimated $3,293,000 million for the period 1958-60.

Completed construction projects include 498 projects carried out by 251 producers. Spending on projects under construction and planned during 1959-60 will be $1,000 million below the $2,540,000 million listed by M.C.A. for the previous period. This decrease is partly ascribed to construction cutbacks made during the mid-1958 recession.

Spending on general organic chemicals during 1958-60 tops the list with an estimated $801,433 million. Other estimates are: general inorganics, $797,210 million; plastics and resins $392,745 million; fibres produced by chemical synthesis $254,200 million; petrochemicals, $239,750 million; metals (new facilities for ferroalloys and other special metals refined or modified by chemical processing), $174,757 million; chemical fertilisers, $115,775 million; synthetic rubber, $53,523 million and laboratories, $157,170 million.

★ BRITAIN'S pharmaceutical manufacturers are currently spending about £4 million on research in the never-ending search for new and better drugs. A measure of the work undertaken was given in the House of Commons last week by Mr. R. Thompson, Parliamentary Secretary, Ministry of Health, when he said that on average about 1,000 new substances are synthesised to produce one for the market.

In the past few years whole new drug families have been introduced—some only to be superseded by later developments, others to become major products, such as the antibiotics and steroids. All the time the research chemist is finding new and more powerful tools to aid him.

This background, therefore, makes a third edition of 'The Chemistry of Drugs' most welcome. With a first edition in 1926 and a second in 1938, the latest impression by Ernest Benn, will be read avidly. For the third edition, the author Dr. Norman Evers, former director of research of Allen and Hanburys and now editor of *Analytical Abstracts*, had the collaboration of Mr. Dennis Caldwell of Allen and Hanburys research staff. The book will shortly be reviewed in CHEMICAL AGE.

★ FARMERS in the U.K. are using three times as much fertiliser as they did before the war, and possibilities for continued growth in consumption remains considerable. This is stated by Mr. S. A. Bradburn, agricultural marketing manager of Fisons Ltd., in a report on U.K. fertiliser usage.

About 30% of the cereal acreage still receives no complete fertiliser, but the proportion receiving one has advanced from 66% four years ago to 72% in 1958. The potato crop generally is a well fertilised crop, 95% of the acreage receiving some compound fertiliser. The proportion has risen from 92% in 1955 to 95% in 1958. The sugar beet acreage is fixed and 95% of the crop is today receiving a compound fertiliser.

There is still a long way to go, however, in fertilising grassland. Of 6 million acres of temporary grassland only a third, Mr. Bradburn indicates, is receiving any compound fertiliser although the proportion has risen lately from 27% to 33%. Of permanent grassland only 14% received any compound fertiliser last year.

★ RECENT completion of a 150-ton per day ammonia plant for Coastal Chemical Corporation at Pascagoula, Mississippi, is evidence of the way in which Chemico have tended to dominate the engineering and building of ammonia plants. It is interesting to note that the organisation has been called on by its customers to continue to build and expand ammonia plants, despite the general lull in engineering activity.

During 1958 the number of Chemico ammonia plants completed, under construction or under contract, totalled 12 (five in North America, four in Japan, two in France and one in East Pakistan). This record is all the more significant when one considers that these plants account for perhaps 80% of all the ammonia expansion taking place in the world during this period.

The British subsidiary, Chemical Construction (G.B.) Ltd., tell me that another member of the Chemico family has been formed, Chemical Construction (France) Ltd.

★ MAJOR end use of polystyrene in 1958 was for refrigerator parts which accounted for 23% of total production. Other users were: packaging, 16%; electrical, 15%; housewares, 14%; toys and games, 12%; sheet (other than refrigerators), 8%; shoe heels, 5%; expanded materials, 3%; wall tiles, 1%; miscellaneous, 3%.

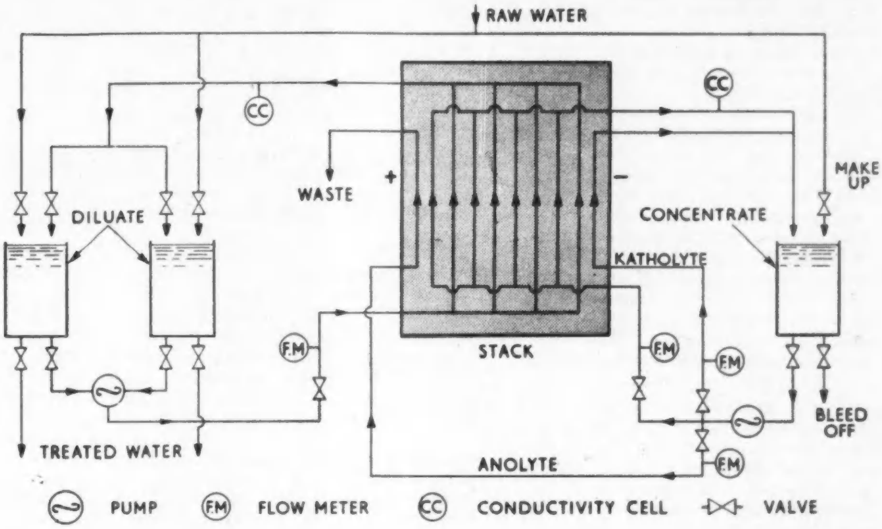
These figures are given in an article in the March issue of *The Shell Magazine*. The writer describes production of polystyrene by the Shell Chemical subsidiary, Styrene Products, at Carrington. Supplies of styrene at present come from Forth Chemicals, Grangemouth, from Canada and from Shell Chemical, Torrance, U.S. A further source of supply will be provided on the completion at Carrington in 1960 or 1961 of the £1.75 million styrene monomer plant announced by Shell Chemical in 1956.

The bead polymerisation process is used at Carrington because it allows flexibility and great accuracy in the control of the molecular weight. The expanded polystyrene unit came into production last year and the product, Styrocell, is made on a machine that is operated under licence from the Swedish firm of W.M.B. International A.B.

Alembic

BOBY ELECTRODIALYSIS DESALTING PLANT

88,000 Gall. Per Day Plant for Tobruk



Flow diagram of typical electrodialysis desalting plant

FOLLOWING the installation of an experimental electrodialysis water desalting plant by William Boby and Co. Ltd., Rickmansworth, Herts, in Tobruk nearly 18 months ago for the Libyan Public Development and Stabilisation Agency, the company have now received a further order for a plant to treat 88,000 gall. per 24-hour-period of Tobruk saline water reducing it to a salinity of 500 parts per million.

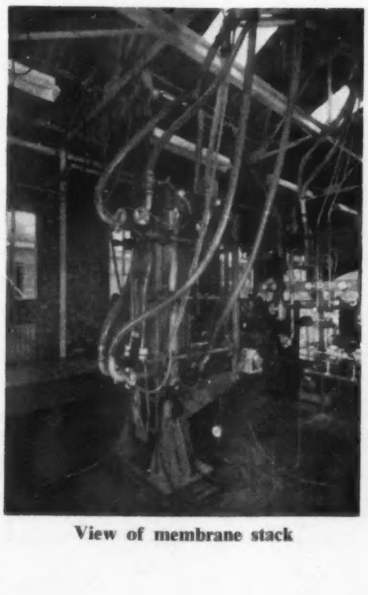
Experiments with Boby's pilot desalting plant have shown the value of the plant in sweetening the brackish water supplies at Tobruk, and indicate that the company has developed a Dutch patent into a commercial proposition. The pilot plant now producing 160 gall. fresh water from the salty Wadi Sahal and Wadi Aida supplies, will be used to replace the fresh water tanker service plying between Tobruk and Bandia. By next year Mr. W. Michael T. Boby, chairman and managing director of William Boby and Co., reports £L50,000 electrodialysis installations will be feeding fresh water into the Tobruk main water pipes at the rate of 125,000 gall. daily. Operators for the plant will gain experience on the pilot installation capacity of which is to be increased.

As a result of Mr. Boby's visit to Tobruk, commercial production of skid- and trailer-mounted plants for use in desert camps, such as those associated with oil-drilling operations, is envisaged. The electrodialysis installation, Mr. Boby states, can extract almost any mineral density, although over a certain limit the cost becomes uncommercial. The Tobruk plant will reduce the mineral content from 5,000 p.p.m. to 500 parts, making the water completely drinkable.

William Boby and Co. have in recent years been carrying out extensive research and development work in connection with conversion of saline waters by electrodialysis. This work has been carried out in co-operation with the Department of Scientific and Industrial Research and its Dutch counterpart, the Central Technical Institute—T.N.O. The company is the British licencee of the T.N.O. patents.

Fundamentally, the process depends on the fact that saline water, in contradistinction to pure water, is an electrolyte. The 'heart' of the electrodialysis plant is the stack which consists essentially of a number of anionic and cationic membranes arranged alternately between two electrodes which are connected to a direct current source. Desalting takes place in every second compartment. Sodium and chloride ions thus removed are built up in the remaining compartments and the process is continued until the required reduction in salinity is attained.

In practice, a complete electrodialysis plant consists of a stack of membranes spaced and contained within a suitable casing which also houses the positive and negative electrodes, tanks storing the diluted and concentrated solutions, circulating pumps, and some instrumentation to enable the process to be accurately controlled. The plant is largely automatic in operation and can be supervised by one trained but unskilled man, with some assistance during maintenance which is largely confined to replacing membranes at infrequent intervals.



View of membrane stack

Membranes at present in use on the pilot plant in Tobruk are of the old heterogeneous type manufactured from polythene powder and ground ion exchange resins. These have proved perfectly satisfactory, chemically and electrically, but so fragile that extreme care has to be used to ensure that out-of-balance pressures do not occur inside the membrane stack. A further problem raised by their fragility lies in the difficulty of packing the membrane stack in the first place. Before Boby's mastered the technique of repairing slits and tears, many membranes were wasted.

Within the next two or three months the membranes in the Tobruk stack will be replaced by a relatively new type of homogeneous membrane of U.S. manufacture, made by treating polythene film and having approximately the same mechanical properties as polythene film. The Dutch C.T.I.-T.N.O. have also produced a somewhat similar membrane which is equally satisfactory. In this country D.S.I.R. have been working on the production of homogeneous membranes for two years or more but have so far not produced a membrane which they are prepared to submit for trial. A large chemical manufacturing company in this country, however, has also produced an extremely good positive membrane, and it is expected that production of a negative membrane as well will soon be announced.

Initially one of the main difficulties in

constructing the plant was the choice of materials of construction for the different component parts. The raw water the plant is designed to treat is high in chlorides and hence corrosives. It is therefore necessary during the operation of the process to acidify at least two of the streams of water in order to prevent precipitation of insoluble hydroxides. In addition to this problem there is a considerable d.c. potential applied to the electrodes, and inevitably stray currents are carried out in the streams of water circulating through the plant. These currents tend to accelerate any corrosive action already present, and moreover are corrosive in themselves. Also, at the anode normal electrolysis occurs, and since the waters to be dealt with contain chlorides, quite large quantities of chlorine are produced. This is highly corrosive and requires special materials of construction.

Boby's entire plant is constructed from dielectric plastics materials such as high impact p.v.c., styrene-butadiene rubber and polythene. Circulating pumps are of bronze construction nylon-lined throughout. Instrumentation of the plant has also been carefully considered. Ordinary conductivity meters for measuring the salt content of the water at any stage during the process proved to be unsatisfactory, since they were seriously affected by the stray electrical currents carried in the water stream. Similarly affected were the pH cells but the problem was soon overcome by earthing the streams of water into the cells and out of them. This earthing was accomplished by means of sections of graphite pipe on inlet and outlet of the cells. The instruments now used are all perfectly stable and accurate over a very wide range.

Platinised Ti Anodes

In the early days of development of the electrodialysis plant, 18/3 stainless steel was used for the cathode, and magnetite-coated mild steel for the anode. The stainless steel cathode proved entirely satisfactory, but the magnetite anode had several snags. It proved expensive and very fragile, and once damaged corroded extremely rapidly. The life of the magnetite coating which was about ¼ in. thick, appeared to be about 18 months after which a new anode had to be used. Eventually, in the attempt to find a more satisfactory anode, I.C.I.'s platinised titanium electrodes were examined. Titanium by itself could not be used, since an insulating oxide layer rapidly formed on its surface and prevented the flow of current. Deposition of a layer of platinum about 1/5th of a thou. thick, however, overcame this difficulty. The platinised-titanium electrodes have proved satisfactory as anodes and as they are relatively cheap their use has been adopted for cathodes as well. The object of this is to enable the electrical polarity of the membrane stack to be reversed where this is required to be done for purposes of removal of deposits from the stack.

There is no standardised Boby electrodialysis plant, although the stack unit is a standard one. Also, as plant layouts will differ from site to site, exact capital costs cannot be quoted. A plant capable of desalting 1,000 gall. per hour of brackish water containing 5,000 p.p.m. of salt down to potable level at a power consumption of about 20 kWh/1,000 gall. is estimated to cost £10,000. This same plant could desalt 200 gall. per hour of the same water over the same desalting range at a power consumption of about 5 kWh/1,000 gall. Other runing costs to be taken into consideration are capital depreciation, membrane replacement, chemical and pumping costs.

Acheson's Now Market Emralon Range of Resin-Bonded P.T.F.E. Dispersions

REPRESENTING a significant advance in the technique of dry film lubrication and surface coating are the resin-bonded dispersions of polytetrafluoroethylene (p.t.f.e.) now being manufactured and marketed, under the trade name, Emralon, by Acheson Colloids Ltd., P.O. Box No. 12, Prince Rock, Plymouth. P.t.f.e. is already well known as a lubricating solid, having a very low coefficient of friction and good stability at high temperatures, high resistance to chemical attack and excellent 'parting' properties. It has the disadvantage, however, of requiring a very high sintering temperature (about 400° C. before it will coalesce and form a film capable of adhering to a surface). It has not proved easy therefore to apply p.t.f.e. to plastics, rubber, wood or certain metals likely to be affected by the high sintering temperature.

Two Dispersions

Two dispersions in the Emralon range are available, Emralon 810 and Emralon 820. Emralon 810 is a pigmented, resin-bonded coating which is cured at a lower temperature than that required for sintering p.t.f.e. The pigment is p.t.f.e., the binder is a phenolic type resin, flash point is 46° F. and density is 9.9lb./gall. Shelf life of the product, which is a liquid, is two months. Important characteristics of Emralon 810 films include the following: A friction coefficient of 0.05 to 0.07; corrosion resistance is good (applied on cadmium plate and on mild steel which was exposed to standard salt spray tests for over 300 hours, good results were obtained. For maximum resistance on steel a phosphate pretreatment is recommended). The film will withstand 200°C for limited periods and 175°C in continuous use; solvent resistance is such that the coating can be employed in contact with hydraulic fluids, oils and conventional solvents, although strong polar solvents such as esters and ketones should be avoided. This coating is applied by air spray and requires curing for one hour only at 150°C.

Emralon 820 contains a thermoplastic binder and requires no heat curing. It can therefore be used for application to surfaces which are too sensitive even for Emralon 810. This resin bonded-dispersion has a flash point of 40°F and density is 9.7 lb./gall. The friction coefficient of the film as applied is stated to be about 0.05 and 0.07. For maximum corrosion resistance on ferrous substrates, a phosphate pretreatment is recommended. The coating can be used in contact with some weak solvents, but strong solvents soften and destroy the film.

Application of Emralon 820 is by means of spray or dip. The coating is stated to harden in air at room temperature in two hours. It provides a means of imparting the desirable surface characteristics of p.t.f.e. to a wide variety of mechanical parts, and to metals, plastics and other substrates which are structurally rigid.

Further information and trial packs is obtainable from Acheson Colloids Ltd., P.O. Box No. 12, Prince Rock, Plymouth. The Emralon range is being manufactured under licence from E.I. Du Pont de Nemours and Co. under British Patent No. 804,178. It is not licensed for use or for sale for use in providing electrical insulation.

First Methane Shipment Was "Very Successful"

FIRST experimental shipment of liquid natural gas in the *Methane Pioneer* has been "very successful" states the Gas Council. After being reformed by the North Thames Gas Board at Romford, the liquid gas is being distributed to consumers.

The *Methane Pioneer*, owned jointly by the Gas Council and Constock Liquid Methane Co., U.S., recently discharged the first trial cargo into storage tanks on Canvey Island, from which it was piped to Romford (CHEMICAL AGE, 28 February, p. 351). The ship is now on her way back to the Gulf of Mexico to take on a further cargo.

New Series of Exams For Lab. Technicians

EXAMINATIONS and qualifications for science laboratory technicians are to be rationalised by the City and Guilds of London Institute and the Institute of Science Technology, both of whom have previously held examinations. In future there will be only one series to be held by the City and Guilds on behalf of both institutes.

Conduct of the examinations and their further evolution will be guided by a joint advisory committee. The rationalisation will it is felt help promote the setting up of courses in technical colleges and universities which will give the technician the comprehensive theoretical and practical training essential if he is to attain a high standard and be able to give the scientist the assistance he requires.

New Process For Calcium Cyanamide

Knapsack-Griesheim's Continuous Method Produces Granulate Carbide

An installation for the continuous production of calcium cyanamide was recently erected by Süddeutsche Kalkstickstoff-Werke AG, of Trostberg, West Germany, in co-operation with the Frankfurt-on-Main concern, Maschinenfabrik Fellner ünd Ziegler. A new production process, developed in the Kalkstickstoff-Werke laboratories by Dr. Kronacher and Fischer and Schücker, makes possible the production—with far better yield and consumption figures, it is stated, obtained using other processes of powder-form calcium cyanamide, from finely-ground carbide by use of a direct current process. Dr. Kaess, of the Kalkstickstoff-Werke staff, has described the process in the February issue of the West German Chemical journal *Chemie-Ingenieur-Technik*.

Calcium cyanamide is produced by the Frank-Caro process discontinuously in so-called settling ovens or by the Polszeniusz-Krauss process in tunnel kilns (**1**).

A continuous process has been developed by the Knapsack-Griesheim AG concern (**2**), by which granulate carbide is produced (**3**) and this, in the presence of a certain proportion of carbide dust plus calcium carbide, after reaction with gaseous nitrogen produces granulated calcium cyanamide. The new Kalkstickstoff-Werke-Fellner and Ziegler installation will operate a process of the following type:

Process Details

Finely-ground carbide (300 l) is mixed in the usual way with calcium cyanamide and fluorspar and blown in, together with gaseous nitrogen, at the top of a rotary drum. The drum is furnished with an extension which acts as reaction space for the process. This reaction area is provided with a so-called calcium cyanamide bed, i.e. an amount of calcium cyanamide, which, among other functions, detains the fusion material occurring during nitrogenation in the pure system; thus the reaction may take place without melting of the reaction material. The resultant product of the process is calcium cyanamide in powder form, which is sluiced from the nitrogenation rotary drum in which reaction took place into a cooling aggregate. The process may be so carried out as to obtain a greater or lesser amount of end-product calcium cyanamide.

Lay-out of a production installation is as follows (**4**):

A mixture of carbide, calcium cyanamide and fluorspar is released from the bunker through a bottom outlet, injected with gaseous nitrogen and passed through a tube into the reaction area by a blowing process. The reaction area is a rotary drum 2.6 metres by 3.1 metres. After the reaction has taken place, the calcium cyanamide formed is passed through the narrowed end of the drum and through the precipitation well into a cooling drum. From the cooler the calcium cyanamide is directed through the exit channel either through a sieveing apparatus for the production of granulated calcium cyanamide or through a fine grinding mill for the manufacture of calcium cyanamide dust.

The process technique.—Capacity of the Kalkstickstoff-Werke installation lies at between 11 and 12 (eleven and twelve) tonnes of nitrogen daily and a scheme is on hand for the setting-up of plant with a daily capacity of 25 tonnes N. The operating furnace is set at between 1,000 and 1,100° C. according to the quality and type of carbide used, the reaction enthalpy of $\triangle H = -67.1$ kcal/g-Mol at 1,100°C (**5**) corresponding to the reaction $CaC_2 + N_2 \rightarrow CaCN_2 + C$, supplying the required heat for the process (heating of basic materials, heat conduction by cooling etc.).

The particularly finely-ground carbide is blown through a lance tube on to the calcium cyanamide bed. The finer portions are naturally more quickly nitrogenated than the coarser-ground fragments, though there is no great difference in the granulation sizes.

Dependence of the time needed for nitrogenation on the size of the granules presents an exponential function (**6**). It is advantageous to use particularly finely-ground carbide; the higher reaction speed caused by the use of such a material also reduces the size of apparatus.

No Post-degassing

On leaving the reaction area it is found that the nitrogen has combined with the carbide to more than 98%, leaving only about 1% of carbide still free; by the time the narrowed end of the reaction drum has been reached this quantity has sunk to between 0.03% and 0.05%. No post-degassing process is therefore necessary.

In the cooling installation, which may take a different form from that described above, calcium cyanamide is cooled down to 50°C. The reaction pipe is coated with heat-insulating material, to avoid losing the heat resulting from the reaction by radiation losses. Once started, the process continues with specially supplied heat; the advantages of this, both technical and scientific, are not inconsiderable.

Economics of the process. If current and material consumption of the process are compared with the consumption figures of former processes cited in technical literature (**7**), the following statistics per 100 kilograms of latent nitrogen are obtained:—

	Frank-Caro Process	*New Rotary Process*
Kilogramsgroundcarbide (300 l.)	316	290-294
Cubic metres nitrogen	190	135
Kilograms fluorspar ...	8.2	5.0
kWh electric current ...	35	25
Working hours	1.4	0.2

Space needed for the installation is smaller than with other processes since ground carbide is used and the calcium cyanamide made from it is produced in dust or fine-grain form. Both post-degassing and size-reduction apparatus therefore became redundant. The process can be combined with a whirling method of nitrogenation, for example, with one in which pre-nitrogenation takes place on a whirling bed (**8**). Whirling-bed nitrogenation has been exhaustively studied by the Badische Anilin- und Soda-Fabrik scientists G. Hamprecht and H. Gettert (**9**) and the Knapsack-Griesheim staff members F. Rodis and F. Hartmann (**10**).

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Methane Project Discussed in Parliament

Asked to say to what extent the recent experimental import of liquefied gas had proved successful, the Paymaster-General, Mr. Reginald Maudling, stated that the first cargo had been shipped and discharged into storage tanks without incident, but at least two or three more trial voyages might be necessary before the technical and economic possibilities could be fully assessed. With regard to the effect transport of liquefied gas would have on the coal industry, Mr. Maudling indicated that if importation of gas proved successful in the long term it should provide a much cheaper source of gas for the consumer. It should not, he added, impede the new methods of developing the gasification of small coal.

On the question of the cost of the liquefied gas experiments, the Paymaster-General said that it was an exciting and encouraging new experiment. The cost of the experiment to the gas industry was, he understood, to be £1½ million, which was its share of the project, the rest being provided by the U.S. interests concerned.

O.C.C.A. Change of Address

The Oil and Colour Chemists' Association has moved to Wax Chandler's Hall, Gresham Street, London E.C.2 (Monarch 1439).

PROCESS DETAILS OF NEW U.S. 305 TON-PER-DAY AMMONIA SYNTHESIS PLANT

RECENTLY completed by Foster Wheeler Corporation, U.S., for Petroleum Chemicals Incorporated, at their Lake Charles, Louisiana, petrochemical plant, was an ammonia synthesis installation which produces from refinery tail gas and air, 305 short tons per stream day (100,000 tons per year) of liquid anhydrous ammonia.

For production of 305 tons of ammonia per day, 6.8 million cubic feet per day of nitrogen and 20.4 million cubic feet of hydrogen per day are required. Nitrogen is available in unlimited quantities in the atmosphere and obtainable by fractionation of liquefied air.

In this installation hydrogen is available in substantial quantities in the tail gases from three dihydrogenation processes: platforming in the Continental Oil Co. refinery, hydroforming in the adjacent Cities Service refinery, and the butadiene plant of Petroleum Chemicals. These gases contain different percentages of hydrogen and various impurities characteristic of their source.

Removal of impurities and recovery of pure hydrogen from these combined gases is accomplished by chemical treatment, low-temperature fractional condensation and by selective absorption in liquid nitrogen with an atmospheric boiling point of $-320°$F, which is lower than that of carbon monoxide ($-313°$F) the lowest boiling point of any of the impurities. The two streams of pure hydrogen and nitrogen are blended in molal proportions, 75% hydrogen and 25% nitrogen, and are catalytically synthesised to ammonia.

Major sections of the complete plant are the compressor section, purification sections, low temperature separation unit, air separation unit, Casale ammonia synthesis section, refrigeration section and instrumentation.

Compressors

Compressors. Six compressors are used to move the gases through the various sections at specified pressures. They are divided, two each, into three general service classifications: hydrocarbon gases, non-hydrocarbon gases and synthesis gas.

Two 50/60% capacity compressors are used for a specific service instead of one 100% capacity and a spare, and this greatly reduces initial investment cost.

Purification section. The hydrogen-rich feed gases are purified by absorption in monethanolamine (MEA) and caustic soda for removal of carbon dioxide and hydrogen sulphide. They are also cooled, chilled and dried for removal of water and entrained heavier hydrocarbons.

Low temperature separation unit. The purified feed gases separate into four streams by fractional condensation and absorption into liquid nitrogens—methane for plant fuel, ethane to the ethylene plant, carbon monoxide to flare, and a hydrogen-nitrogen stream, containing 0.1% impurities for ammonia synthesis.

Air separation unit. Air is washed with caustic, chilled, dried and separated into oxygen and 99.9% nitrogen for ammonia synthesis. At present, the oxygen is vented to atmosphere, but the economic feasibility of using it to accelerate catalyst regeneration in fluid catalytic cracking units is being studied.

This unit and the low temperature separation unit were supplied by L'Air Liquide.

Casale ammonium synthesis plant. The volumetric mixture of 75% hydrogen and 25% nitrogen (syngas) is compressed and catalytically converted into anhydrous ammonia in a specially designed Casale converter.

Recycle Ejector is a Major Feature

One of the major features of the Casale ammonia synthesis process is the ejector which recycles unconverted nitrogen and hydrogen back to the converter. High-pressure purge valves and ejector bypass valve are pneumatically operated from the control room. Foster Wheeler state that the Casale converter at Petroleum Chemicals is the largest single high-pressure reactor in the industry. It weighs 180 tons, has a 9-in. wall and is fabricated in multiple layers. This vessel not only holds the catalyst, but is also a heat exchanger utilising the heat of the outgoing gases to preheat the incoming feedstock. Other advantages are that erection cost is considerably reduced due to simplicity in piping and low cost of the ejector in comparison with recirculation compressors; high effieciency is achieved by minimising leakage, and oil contamination into the passing gases; an inherent disadvantage of mechanical compression systems, is eliminated.

Refrigeration section. Ammonia and ethylene refrigeration systems provide liquid refrigerants for chilling and/or condensing feed and product gases as required.

The process. The three feed gases enter separate stages of a multi-gas compressor (A) and are compressed to 400 p.s.i. The compressed hydroformer and butadiene feed gases, after cooling, enter the CO_2 absorber, where CO_2 is removed by absorption in monoethanolamine. The saturated MEA flows from the absorber to the MEA reactivator where carbon dioxide is stripped out. The reactivated MEA returns to the absorber.

The outlet gas from the absorber joins the compressed platformer feed gas and the combined stream of three gases then enters the caustic scrubber where traces of CO_2 and H_2S are removed. The purified gas is chilled, dried and enters the low-temperature separation unit (L.T.S.U.), where it is separated into three by-product streams and commercially pure hydrogen, mixed with nitrogen which has vaporised in the liquid nitrogen wash tower. Sufficient nitrogen is added to make up the molal proportions of 25% nitrogen and 75% hydrogen the synthesis feed gas for ammonia synthesis.

Nitrogen flows from the air separation unit into compressor (B). Part of this stream, compressed in three stages as indicated to 390 p.s.i. is the blending nitrogen used to provide the 75:25 mixture of hydrogen and nitrogen. The remainder of the nitrogen is compressed in two more stages in compressor (B) to approximately 3,000 p.s.i. and enters the L.T.S.U. where part of it is liquified and used to absorb the light hydrocarbon gases and other impurities of the feed gas. The other part is used as refrigerant in a closed system and is recirculated to the high-pressure nitrogen stages of compressor B.

Syngas enters the multi-stage compressor (C) and its pressure is raised to approximately 7,500 p.s.i. After cooling, it enters the Casale ejector which functions as a recirculating unit for the unconverted nitrogen and hydrogen. The once-through yield of anhydrous ammonia is approximately 25%. Practically all of the feed gas is ultimately converted to ammonia. Fresh syngas from the compressor and the unconverted nitrogen and hydrogen recycle from the high-pressure separator join into one stream in the ejector and enter the Casale converter where the exothermic union of hydrogen and nitrogen is completed to produce ammonia. Ammonia vapour is condensed and, mixed with the recycle gas, enters the high-pressure separator.

Final Stages

The recycle gas then flows to the ejector and the liquid anhydrous ammonia, under liquid level control, flows to the low-pressure separator. In this vessel any absorbed syngas is flashed off and returns to an intermediate stage in the syngas compressor. Liquid ammonia flows from this separator through a chiller, refrigerated by ammonia refrigerant, into a let-down drum. In this drum, a small amount of ammonia is flashed off and recovered in a condenser using ethylene refrigerant. This material joins the main stream of anhydrous ammonia as it flows to storage at 35°F. and 50 p.s.i.

Instrumentation throughout the plant is pneumatic with miniature case instruments, mounted on a graphic panel in the main control room. The compressor unit installation includes automatic analysers which continuously indicate content of acetylene and ethylene in the liquid oxygen reboiler, saturated and unsaturated hydrocarbons in the air, acetylene in the butadiene feed gas, and hydrogen in the synthesis feed gas and high pressure recycle.

Purification of Hydrogen

Harwell Research Work on Large-scale Continuous Production of Deuterium

OF IMPORTANCE in the distillation of hydrogen at 20°K for the large-scale, continuous production of deuterium, is the prevention of the feed-gas heat exchangers becoming blocked by the solid impurities which are condensed. This is particularly the case when feed gas is derived from ammonia synthesis or oil refinery plants. In a previous paper W. H. Denton, Dr. B. Shaw, and D. E. Ward, U.K. Atomic Energy Authority, Harwell, Berks (*Trans. Inst. Chem. Engrs.*, 1958, **36**, 179) discussed a solution by methods similar to those used in air separation plant, whereby it was proposed that regenerators or reversing heat exchangers or both down to temperatures below 63°K (where solid nitrogen starts depositing), and switching dual exchangers below about 50°K, should be used. Absorbers were not considered attractive, especially for high concentrations of impuity as they required periodic regeneration.

Experiments Described

At the Spring Meeting of the Institution of Chemical Engineers held at Church House, London S.W.1, on 17 March, W. H. Denton, Dr. B. Shaw, R. Gayler and P. Seager, Atomic Energy Authority, Harwell, Berks, described experiments at temperatures down to 80°K with a plate-fin type of reversing heat exchanger with interrupted or "multi-entry" fin corrugations, which operated successfully as a purification unit with no 'blow-down' of solid particles. They reported that the plate-fin heat exchanger was suitable for low temperature gas separation plant and was now used fairly extensively. The standard 'multi-entry' fin corrugations were selected for these experiments as they seemed suitable for trapping any solid particles of impurity in the gas stream. They also had advantages over the plain fin corrugations in that they provided a smaller total volume of heat exchanger for a given heat transfer and pressure-drop duty, and provided as well completely stable heat transfer performance throughout the region between viscous and turbulent flows

With regard to the supersaturation problem. Denton *et al.* noted in their previous experiments that the deposit produced was a smooth compact layer for high Reynolds numbers but for values less than 1,500 (i.e. about 1,000) the solid layer became very loose and particles were detached and transported in the gas stream. In the present experiments, the effect of the Reynolds number has been disregarded and the effectiveness of the interrupted fins for providing nucleation centres and trapping any solid particles was investigated. The Reynolds numbers, based on individual channels between the fins, were stated to be only about 300, the same as would be used in a full-scale plant to satisfy typical heat transfer and pressure-drop duties.

The exchanger was basically a two-stream exchanger in which the high pressure feed-gas was cooled counter-currently by the pure low pressure return-gas leaving the distillation column and, by periodically switching the two gas streams, the solid impurities deposited by the feed-gas were evaporated into the low pressure gas leaving the plant.

Supersaturation and fog formation were considered. The degree of supersaturation was stated to be much greater for hydrogen than for air and a much greater proportion of the impurity would tend to condense as solid fog particles and be carried down to a lower temperature level where it would not be fully evaporated. The degree of supersaturation also decreased as the temperature difference was decreased, but this was still quite serious for the small temperature differences used. A further adverse consequence of supersaturation was that the solid impurity might adhere only loosely to the heat transfer surface and would be readily detached and carried down to too low a temperature for evaporation. One of the principal objects of the present experiments had, therefore, been to investigate the possibility of using suitable fin corrugations, for the plate-fin heat exchangers.

Plate-fin Exchangers

Objectives. The points for study, using the plate-fin exchangers, were: to see if the 'blowing-down' of solid particles of impurity to the cold end of the heat exchanger was suppressed; to measure the rate of accumulation of solid in the heat exchanger (the criterion for their successful operation); to study the detailed pattern of condensation and evaporation of impurity and detect any blowing down of solid particles at intermediate temperature over the range of solid deposition; and to determine the cause of any accumulation.

Apparatus. Hydrogen from the gas holder was compressed to 10 atm. and passed through valves at a flow rate of 600 ft.^{3}/min., cooled to about 80°K in the heat exchanger, expanded through another valve to 1.1 atm. abs., cooled further in a coiled tube immersed in liquid nitrogen, heated back to room temperature in the heat exchanger, and finally returned to the gas holder to complete the cycle.

The heat exchanger consisted of five vertical blocks, each 5 ft. long, connected in series and arranged in a circle, with three asbestos spacer discs. Carefully shaped headers with 1 in. bore connecting tubes were used for the main hydrogen streams to reduce maldistribution of flow. Each of the five channels contained fin corrugations with 10 fins per inch, 0.010 in. thick and with a multi-entry design. The whole unit was of the brazed aluminium-alloy construction used for large-scale units. The main stream connections at the cold end and the gas-sample and thermocouple tubes all terminated in copper tubes, joined to the aluminium by a flash butt welding technique. Conventional compression fittings were only used for the main stream connections at the warm end where there were no differential contractions.

Absence of CO_2

Results. The most striking results were the complete absence of CO_2 at the cold end of the heat exchanger and the fact that solid particles of CO_2 could not be detected in the condensing gas stream, even in the region of solid deposition. The findings were attributed mainly to the efficient action of the fin corrugations. The rate of accumulation of solid CO_2 in the heat exchangers, after an initial period of high accumulation fell to a steady value which was only about 1.4 p.p.m. of the total molar feed rate for 0.4% CO_2 feed concentration and was apparently less for 0.04% CO_2. This low value for the long term accumulation rate was considered very satisfactory and would be acceptable in practice. Initial accumulation, it was stated, was not due to the transport of detached solid particles by gas surges on reversal. It increased with concentration over the whole range. Although temperature differences varied in the experiments, it was considered unlikely that that invalidated the conclusion that the initial accumulation was independent of surface area. No completely satisfactory explanation of initial accumulation had yet been found.

Conclusions. Experiments with CO_2 concentrations in hydrogen of up to 1% had conclusively demonstrated that a reversing heat exchanger of the plate-fin type having closely spaced multi-entry fin corrugations was suitable for the purification of hydrogen in a hydrogen distillation plant down to temperatures of 80°K. Despite the high degree of supersaturation of impurities in hydrogen, adherence of the solid impurity deposits in this type of heat exchanger was stated to be very good and there was no transport of solid particles of impurity in the gas stream. This result was attributed mainly to the interrupted surfaces of the

'multi-entry' type of fins providing efficient nucleation centres and trapping any solid fog particles. The measured long-term accumulation of CO_2, less than 2 p.p.m. of the molar feed, was low enough for the solid accumulation not to be important in determining the maximum on-stream period of a hydrogen distillation plant. By using slightly lower temperature differences than in the experiments reported above, it is believed that the experimental figure could probably be reduced.

Further experiments using concentrations of up to 5% CO_2 showed that the plate-fin reversing exchanger could be developed for higher concentrations of impurity in hydrogen, the essential result being that good adherence of solid, and absence of 'blow down' of solid particles continued for deposits up to at least 0.018 in. max. thickness for a fin spacing of 0.090 in., corresponding to 40% blockage of the heat exchanger cross section where deposition commences.

The suitability of multi-entry plate-fin heat exchangers for use as alternating dual heat exchangers for low temperature hydrogen purification was also confirmed.

Normal deposition as a fairly dense solid with very good adherence continued until blockage was practically complete. This permitted the maximum on-stream period to be used for such units, determined by pressure drop limitations only, thereby reducing the refrigeration load to a minimum.

The maximum thickness of solid deposit that could be tolerated was the most important design factor and the overall refrigeration load could be shown to be almost inversely proportional to this quantity. A direct advantage was gained by increasing the fin spacing in the region of high deposition, or even grading it along the exchanger channels. Units can therefore be designed for a calculated maximum thickness of solid deposit approaching complete blockage, at least for a fin spacing of 0.090 in.

Similar experimental information on the deposition of other impurities at the lower temperatures, such as nitrogen between 63°K and 20°K were still required for this type of plate-fin heat exchanger.

Head Wrightson Supply 90 ft. Dryers for Fertilisers

TWO dryers of the parellel flow single shell type, 12 ft. in diameter by 90 ft. long and among the largest of their type ever built have recently been supplied to I.C.I. by Head Wrightson Stockton Forge Ltd. With a capacity of about 180 tons per hour they will be used in the production of fertilisers. The company also supplied I.C.I. with four ball mills and two coolers. All the equipment was designed and engineered by the company, which is a subsidiary of Head Wrightson and Co. Ltd.

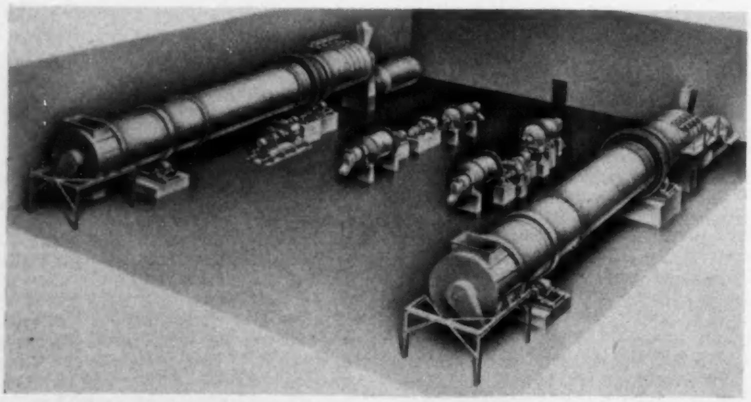
To ease transport and erection and to assist in the alignment of these dryers, the shells were made in three pieces, the joints being machined with spigotted flanges, connected on site by fitted bolts. This also greatly aided erection. The dryers are provided with two heavy cast steel tyres mounted on machine cast steel chairs on the shell with girth rings of cast steel with machine cut teeth. The section rings are attached to inner carrier rings by fitted bolts. Both tyres and girth ring assemblies are mounted on heavy-machined stiffening bands welded to the shells and these bands were machined in one operation with the flanged and spigotted joint rings. Cast iron labyrinth seals are provided at the feed ends of the machines to prevent ingress of air and the leakage of material.

Powered by 300 h.p. squirrel cage motors through fluid couplings and totally enclosed helical reduction gear units, the drives are connected to the main countershafts which carry the forged steel pinions by flexible couplings. The bearing wheels are of cast steel running on Timken taper roller bearings on fixed spindles carried in heavy dead eyes on the bedplates. Similar construction is employed for the thrust wheels.

The roller bedplates are fabricated from steel sections and plates with machined pads to accept the adjustable bearing wheel supporting dead eyes and the trust plates are also made and machined to accommodate the cast steel thrust stands which carry the wheel spindles. As the material being handled is likely to become sticky under certain circumstances, 'knockers' are provided near the feed ends of the shells to assist in preventing accumulations of material in this area. There are four pneumatically operated 'knocker' units controlled by electrically driven rotary valve units, enabling the sequence and timing between units to be varied over a fairly wide range. Discharge of oversize material is achieved by radical lifters through a central cone outlet.

The four ball mills are 7 ft. in diameter by 7 ft. long and each is driven by machine cut spur gears through reduction gears and flexible couplings from 200 h.p. motors.

One of the coolers is 12 ft. in diameter by 75 ft. long and the other 11 ft. in diameter by 70 ft. long. Arranged for counter flow working they will handle similar materials to the dryers.



An artist's impression of the rotary dryers and ball mills supplied to I.C.I. for the production of fertilisers

Major Uses for New Reinforced Plastics

A RESIN-IMPREGNATED fabric in the form of dry, semi-rigid sheets, which can be formed under heat and moderate pressure to make reinforced plastic components of complex shape, is a new development by Leicester, Lovell and Co. Ltd., North Baddesley, Southampton. The outstanding advantages claimed for this product, Resnit, are said to be its practical suitability for mass production and its cheapness. Many large-scale uses are predicted for Resnit, including moulded bodies for popular cars, building fitments, office equipment, air ducting, rigid and acid-resistant containers, radio cabinets, toys, etc.

The new process can be used with several different types of fibre and of impregnating resin, but attention is currently centred on the grade of Resnit in which, for reasons of convenience, availability and cost, cellulosic fibres are used with a phenolic resin as the impregnant. For applications where a higher degree of chemical resistance or dimensional stability is needed, the knitted cellulosic fibre can be replaced by knitted glass or one of the synthetic textile fibres.

Anti-dumping Duty Sought on Pentaerythritol

The Board of Trade is considering an application for the imposition of an anti-dumping duty on pentaerythritol containing not more than 20% by weight of dipentaerythritol imported from Canada. Representations should be addressed in writing, not later than 7 April, to the Board of Trade, Tariff Division, Horse Guards Avenue, London S.W.1.

Acetonitrile as Distillation Solvent Boosts Throughput

PLANS to set up a commercial plant to produce acrylonitrile using propylene and ammonia were announced recently by Standard Oil, Ohio, U.S. (CHEMICAL AGE, 7 March, p. 407). A by-product of the process would be acetonitrile and the question in U.S. scientific circles was the potential outlet for the chemical. According to Union Carbide Chemicals Co., acetonitrile is an unusual solvent useful in saturate-unsaturate and olefin-diolefin separations. By using acetonitrile as an extractive distillation solvent, Shell Chemical Corporation, U.S., Union Carbide Chemicals report, have boosted throughput of their existing butadiene feed-preparation by 58% in their Torrance plant.

Minor engineering changes cost $148,000 (£50,000 approximately) but it has been estimated that a similar throughput increase through new construction would cost about $3,000,000. Development work and operational experience have shown also that the unusual solvent properties of acetonitrile should prove useful in other saturate-unsaturate and olefin-diolefin separation processes.

Capacity Boosted

Acetonitrile has boosted capacity in the Shell plant because it increases the spread of boiling points of the C_4 hydrocarbons being distilled. Separation of the hydrocarbons is claimed to be more efficient than with either acetone or furfural. Relative volatility of *n*-ported to be about 1.25 with acetone butane compared to butene−1 is re-and about 1.30 with furfural. Acetonitrile increases this ratio to almost 1.4. The spread in boiling points of butene −1 and butadiene is also increased. After extractive distillation is completed, acetonitrile can be completely recovered from the butane and butylene streams with greater ease than acetone. This increased recovery, Union Carbide say, is due to the high distribution coefficient of acetonitrile in water/hydrocarbon systems.

Because of the similarity of the physical properties of acetonitrile and acetone, no change in operating pressure of extractive distillation columns is required. Shell engineers made only minor changes to their unit, it is reported. Besides a larger reboiler and a new pump, two heat exchangers were switched and the solvent recovery column was connected to vacuum operation. Another point made is that aqueous acetonitrile systems do not foul exchanger systems. Corrosion due to hydrolysis of solvent at reboiler temperatures is minimised by pH control. The butadiene feed-preparation unit operating on acetonitrile is claimed to have less solvent-loss than one operating in acetone. Therefore, solvent make-up costs are no higher with acetonitrile than with acetone. Steam and pumping costs have also been reduced because reflux and circulation rates are lower, even at reduced feed rates.

Other processes in which acetonitrile is said to be useful is ethylene-ethane, propylene-propane and cyclopentadiene-cyclopentane separations. Boiling point spreads between pentadienes, such as isoprene, and pentenes are also found to be increased.

In liquid-liquid extraction processes acetonitrile is reported to be effective in removing tars, phenols and colour bodies from hydrocarbons. Acetonitrile is also useful as a selective solvent for fatty acids.

Prof. Hilditch Opens O.C.C.A. Exhibition

ELEVENTH Technical Exhibition, Oil and Colour Chemists' Association, London Section, was opened on Tuesday, at the New Horticultural Hall, London, by Professor T. P. Hilditch, Emeritus Professor of Industrial Chemistry, Liverpool University, and an honorary member of O.C.C.A.

Before the official opening members and guests attended the exhibition lunch at the Criterion Restaurant, London. In his address of welcome, Mr. H. C. Wordsall, London chairman, said that 300 sixth form science students would visit the exhibition. They would be given details of the type of training they would have to undergo if they entered the industry.

Referring to the Paint Research Station, Mr. Wordsall said that its income was £65,000 a year, of which two-thirds came from the industry. Subscriptions represented about £300 per company, or probably less than 0.1d. on a gallon of paint. The industry's turnover was about £139 million a year. The Station must have more money and it might be that it would have to follow the example of some industries in which research associations were paid according to the turnovers of member-firms.

Responding, Professor Hilditch said that some directors complained of a difficulty in understanding what their research departments were doing. Chemists could not, however, report on technical developments in layman's language; directors should try to learn something about their businesses.

Our exclusive preview of new exhibits was featured in 'Chemical Age' last week. Our next issue will contain an illustrated report of the exhibition.

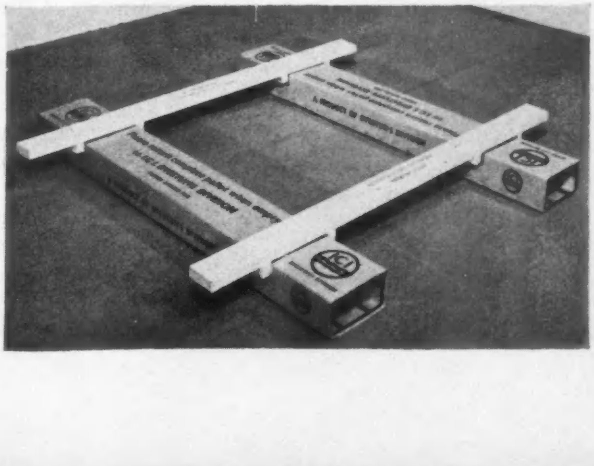
Manchester Firm to Market New Pallet Devised by I.C.I. Dyestuffs Division

AN important new development in the materials handling field—the Manjute rigid pallet—is now being marketed by Thomas Manning Sons and Co. Ltd., Manchester. They are operating under licence from I.C.I. Dyestuffs Division, who originated the idea and who have applied for patent protection.

This new equipment is a cheap, lightweight rigid pallet of the sleeve type, designed for the handling, by fork lift truck, of paper or hessian sack-packed materials, although other types of packages, provided they are flat-topped, with no projections, can be handled quite satisfactorily on the new pallet. The Manjute is collapsible for easy storage or return transport, occupying only a fraction of the space needed for a wood pallet.

The two sleeves are of welded steel mesh, the entry points being 6 in. wide by 3¼ in. deep, with strong fibreboard covers that can usefully be printed with the owner's name and address or with publicity matter. Two or more wooden deck pieces are fitted across the sleeves.

Initial cost of the pallets is about 21s per unit, said to be substantially cheaper than the ordinary wood pallet. More efficient use of store and warehouse accommodation is also obtained.



The assembled Manjute rigid pallet

Control room of I.C.I.'s new oil gasification plant which will use the Texaco process

I.C.I. HYDROGEN PLANT GIVES C.J.B. BIGGEST INSTRUMENTATION PROJECT

AN oil gasification plant, utilising a new, largely automatically controlled process for the large-scale production of hydrogen has recently been completed by Imperial Chemical Industries Ltd. at Billingham-on-Tees. At the peak of the installation work, some 200 skilled and semi-skilled men were employed on the instrumentation together with supervisory staff comprising a site manager, three engineers and eight foremen. This is believed to be the largest labour force of its kind ever used in this country on an instrumentation contract.

Site erection of the extensive instrumentation and control equipment for the process was carried out by the Automatic Control Division of Constructors John Brown Ltd. over a period of 18 months.

The plant is highly instrumented and to a great extent automatically controlled; it is equipped to an unusually high degree with safety locks, alarms and signals. Over three miles of instrument impulse lines were installed, together with a further 18 miles of small bore copper and 10 miles of multicore plastics tubing for pneumatic transmission.

The main control room, which is air-conditioned, houses two control panels, each 60 ft. long, on which are mounted the flow, pressure and temperature instruments, together with the signal lights, safety locks and motor controls.

Continuous stream analysis and plant performance monitoring is carried out in three separate instrument rooms equipped with analytical instruments which include infra-red hydrogen sulphide analysers, oxygen analysers and a mass spectrometer for quality control. Many important temperatures are monitored continuously and automatically.

New Industrial Waxes from B.B.G.

IN technical service bulletin 59, Division D, Bush, Beach and Gent Ltd., Marlow House, Lloyd's Avenue, London E.C.3, state that B.A.S.F. A-wax has been found to be an effective matting agent for lacquers. Two general types can be considered in this connection, the first being the normal cellulose lacquers where matting is done by simple milling.

It is suggested that 10% of the varnish is passed through a three-roller mill incorporating the A-wax at this stage. Two runs through the mill should give an even dispersion, and this dispersion is then mixed with the balance of the varnish and passed once more through the mill.

For acid catalysed lacquers the following formulation is suggested: 5 parts A-wax B.A.S.F., 38 parts turpentine, and 38 parts toluol, and heat to 80°C until solution becomes clear. To this hot solution a mixture of 38 parts each of ethyl glycol and ethyl alcohol is added while slowly stirring.

The same bulletin describes the new B.A.S.F. gloss intensifier, LK5003, as a stable and largely frost-resistant copolymer dispersion. It is designed for use in anionic dry bright emulsions, such as are produced with olein-morpholine or triethanolamine. The product has a 40% solids content and no additional plasticiser is necessary. The method of use is to add it to the already prepared wax emulsion, such as ES-wax or ES/carnauba mixes, the quantity used being 10-25% of the LK 5003. It is suggested that 1 to 2% of Etingal, which acts as an anti-foaming agent, be added.

Also available from Bush, Beach and Gent is unbleached fibre wax 712, a new wax produced for dry bright polishes and pastes. It has a good paste strength comparable to carnauba and, in addition to giving a high gloss, has markedly non-slip properties. It is said to need less oleic acid for emulsification than carnauba, thus tending to give a harder and more water resistant film. Typical specification is: melting point 78.5°C; setting point 76.5°C; acid value 26.5; saponification value 65.5; ester value 39; acetyl value 41.

Letter to the Editor

Science Correspondent on Liquid Methane Project

SIR,—I can give you an intriguing side-light to your comments on the way the Gas Council handled their first shipment of liquid methane. Like the rest of the press I was told there were no facilities because the "jetties concerned do not belong to the Gas Council". But in fact the jetty owners, the Regent Oil Co., could not have been more helpful to the few people who were not put off by the council's statement.

In my case the Gas Council press officer, Mr. R. S. Hinder, gave instructions that any queries had to be made and answered in writing. This I did in a letter written on 23 February. And I am still waiting for the reply (10 March).

Why this baffling reluctance to divulge even simple details of an enterprise by a state board? Is it because of coal policy, commercial secrecy or perhaps even lack of confidence in their own experiment?

Yours, etc.,

HUGH MCLEAVE,
Science Correspondent.

News Chronicle,
London E.C.4.

£1 m. Nuclear Research Centre for Berkeley

A research centre is to be set up by the Central Electricity Generating Board at their Berkeley nuclear power station in Gloucestershire. The centre will investigate operational techniques and problems that may arise in the running of the first U.K. commercial atomic power stations. The research installation will comprise chemistry, engineering, physics and metallurgy laboratories costing a total of about £1 million. Construction is due to start in September and the laboratories should be ready for use about a year later.

Application for Higher Duty on Monosodium Glutamate

The Board of Trade is considering an application for an increased protective duty on sodium hydrogen glutamate (monosodium glutamate). Requests for a statement of the applicant's case with an undertaking to treat the information contained as strictly confidential and to allow comments to be passed to the applicant for reply, should be sent in writing to the Board of Trade, Tariff Division, Horse Guards Avenue, London S.W.1, not later than 1 April.

Glasgow College to Extend Chemistry Department

Further extensions to the Royal College of Science and Technology, Glasgow, are to begin next year as the start of a programme to increase the present intake of students by almost half. Priority is being given to the erection of a new chemistry and chemical technology department and an extension to the recently completed engineering building. Work on the new chemistry and engineering buildings will begin next year.

Overseas News

ST. GOBAIN COMPLEX PRODUCES EPIKOTE AND DETERGENT RAW MATERIALS

A NEW chemical complex has been brought into operation by Société Anonyme des Produits Chimiques Saint-Gobain at their plant at Berre, near Marseilles, France, adjacent to the oil refinery of Compagnie de Raffinage Shell-Berre. The new facilities will enable Shell Saint-Gobain, in which the Royal Dutch/Shell group of companies has a 60% interest, to manufacture Epikote resins, and base materials for carbon black and for detergents, as well as to expand their range of organic solvents.

Berre is becoming an increasingly important industrial centre in France. It is also at Berre that the Société des Elastomères de Synthèses, a joint company formed by Shell Saint-Gobain, Texas Butadiene and Chemical Corporation, Michelin, Kleber Colombes and Dunlop, are erecting a plant for the manufacture of 50,000 tons per annum of styrene/butadiene synthetic rubber, which is expected to begin production in 1961. (See 'Overseas News', 28 February.)

New West German Urea Plant

The West German coal products company Union Rheinische Braunkohlen Kraftstoff AG, of Wesseling, are erecting a urea plant, the raw materials in the manufacturing process, ammonia and carbon dioxide, to come from the firm's own production units. Most of the urea, which will be produced at an annual rate of 25,000 tonnes as from 1960, will go for synthetic fertiliser or plastics manufacture.

Austrian Firm's Record Output of Nitrogen

The Linz, Austria, firm of Oesterreichische Stickstoffwerke AG, reached a new production record in 1958 with an output of 168,400 metric tons of primary nitrogen. Sulphuric acid, superphosphate and granulated fertilisers formed the main part of the company's production programme, with output of phthalic anhydride, softening agents, plant protection media and pharmaceuticals increasing over the year. All installations worked to full capacity. Turnover, in Austrian Schilling (72-73 per £), was 1,188 million last year, against 1,154 million in 1957 and 910 million in 1956, of which inland sales formed 510 million (469 million; 371 million) and foreign sales 678 million (685 million; 539 million).

Investments totalled 76 million last year (117 million; 152 million). The schemes covered by 1957 and 1958 investments included: Consolidation of the nitrogen production and extension of ammonium sulphate production: erection of a urea plant, a new installation for the production of granulated fertiliser and a plant for the manufacture of sulphuric acid from natural sulphur; and extension of the company's phthalic anhydride plant.

Japanese Companies Expand Polyester Production

Two Japanese companies at present producing Tetron (Japanese trade name for polyester fibre-Terylene) under I.C.I. licence are to expand operations. The Toyo Rayon Co., formerly producing 10 tons of Tetron daily, last month put up daily output to 15 tons and are to raise it later this year to 20 tons, and the Teikoku Rayon Co. Ltd., with a present production of 5 tons of Tetron daily, are to raise their daily production first to 10 tons and by summer 1960, to 15 tons.

Chilean Sugar Producers to Make Chemicals

Industria Azucarera Nacional (IANSA), important beet-sugar producers in Chile, are planning to enter the market this year with several industrial chemicals obtained as by-products of sugar extraction at their three plants located in Linares, Los Angeles, and Llanquihue.

According to information released by the company, IANSA expect to produce 47,000 tons of sugar during 1959. Chemical products to be marketed include some 2,000,000 litres of ethyl alcohol and unspecified amounts of ethyl and butyl acetates, butanol, and acetone.

Long-range planning at IANSA contemplates building up to nine sugar processing plants along the central valley of Chile, to the south of Santiago.

Rumanian Sulphuric Plant

The new sulphuric acid and superphosphate works at Navodari, Rumania, described as one of the largest industrial units to have been set up during the second five-year plan, has recently been put into service. Superphosphates are to be supplied for agricultural purposes before the end of the first quarter of 1959.

Canadian Chemical Production in 1958

The following Canadian production figures refer to the full year of 1958: acetylene, in cylinders for delivery by pipeline, 178,237 million cu. ft.; hydrochloric acid as 100% acid, 37,816,733 lb.; sulphuric acid, all grades including oleum as 100%; 1,495,428 tons; anhydrous ammonia 100%, 346,156 tons; ammonium sulphate, 323,328 tons; chlorine, 267,907 tons; mixed fertilisers, 711,871 tons; formaldehyde, 100% solids basis, 46,612,191 lb.; oxygen, in cylinders or for delivery by pipeline, 1,164,550 million cu. ft.; and sodium hydroxide as 100% NaOH, 309,944 tons.

Ethiopia Plan Pharmaceutical Plant with Evans Medical

A plan for the erection of a large-scale pharmaceutical works in Ethiopia has been announced by the Government. The project, which would be granted technical aid and advice by Evans Medical Supplies Ltd., would require an investment of some 4.5 million Ethiopian dollars (about U.S. $7.5 million). The plant would be particularly concerned in the production of antibiotics and analgesics. The problem which is holding up a final decision at present is whether such a plant could be economic in view of the fact that neither the Ethiopian State nor Evans Medical Supplies have any control over stocks of raw materials, so that all ingredients would have to be imported and the prices of finished products would be higher than those of pharmaceuticals already imported.

Koppers Plan Ethylene/Polythene Plant for Argentina

Industrias Plasticas Argentinas Koppers S.A. (IPAK)—the partly-owned Koppers International C.A. company—is planning to erect Argentina's first ethylene and polythene plant near Buenos Aires. The Export-Import Bank have granted an $8 million loan for the project.

The plant will produce 15,000 lb. a year of polythene initially and is expected to cost $17 million. IPAK are also to build a 15,000 metric ton styrene monomer plant for $7.5 million. It will supply raw material for IPAK's polystyrene plant and monomer to start Argentina's synthetic rubber industry. Both plants are scheduled to be completed by 1961.

W. German Plastics Imports And Exports Rose in 1958

Figures issued by the West German Association of Chemical Industry show that the total of the country's plastics exports in 1958 were valued at DM 560 million (about £46.75 million), a rise of 16% over 1957, which showed a rise of 33% over 1956. Quantitively, exports made up about 26% of all sales in a year when plastics production rose by 15% to 643,000 metric tons.

Plastics formed nearly 12% of all chemical products exported by West Germany, as against a 1957 share of only 10.7%, thus holding their position of second most important branch of the industry after industrial chemicals.

Imports of plastics into West Germany rose by 37% over 1957 to a total value of DM 175 million (about £14.5 million) as against DM 128 million (about £10.75 million) in the previous year. Poly-

merisation products were the main materials imported, forming some three-quarters of all imports and consisting primarily of large quantities of p.v.c., polythene and polystyrene. Almost half the imports came from European countries, those from Italy and the U.K. showing the greatest increase over 1958.

Polymerisation products also headed the list of exports. In 1958 some 75% of all West Germany's plastics exports went to other European countries, as against a share of 72% in 1957. Leading customers remained Holland and the U.K.

New Algerian Research Firm To Study Petrochemicals

A company whose primary job will be research work has been set up in Algeria by three French companies—Société Ethylène Plastique, L'Air Liquide and Huiles, Goudrons et Dérivés. The new firm, Société Algérienne d'Etudes pour la Polymerisation des Oléfines, will study questions connected with the production, processing and marketing of certain plastics, in particular polymers and co-polymers of ethylene and propylene.

Soda Ash Plant Planned For Transvaal

Afrikaans finance company, Federale Mynbou, plans a £2 million soda ash works in the Transvaal. The plant would be located near Sasol and take two or three years to complete. Salt would be obtained from salt pans near Port Elizabeth and lime from the Rand area.

This works would make the Union independent of outside sources of soda ash. Chairman of Federale Mynbou, Mr. W. B. Coetzer, reports that imports totalling 75,000 tons cost over £1 million yearly.

Egypt to Expand Fertiliser Output

The Egyptienne D'Engrais et D'Industries Chimiques S.A.E. of Cairo, which operate a fertiliser plant at Suez, have just been granted an export-import bank credit of $5 million to finance the purchase of U.S. equipment needed for the company's expansion programme. Under this programme ammonia production plant will be enlarged by 50% in order to step up manufacture of ammonium sulphate. Chemical Construction Corporation of New York, U.S., who were responsible for the design of the plant, will act as engineering advisors for the expansion scheme.

GE Offer Evaluation Quantities of Nitrile Silicones

Now being made available to the U.S. market in evaluation quantities by General Electric is nitrile silicone rubber. Union Carbide, another U.S. producer, also expect to produce limited quantities of cyanosilicone elastomers by 1 April. G.E.'s product, NSR-X5602, is the first member of the nitrile silicone rubbers. It is described as a general purpose product, having "intermediate fluid resistance", and is intended for intermittent contact with high-swell liquids or for continuous immersion in milder fluids, e.g., airplane seals, boots, diaphragms, and shock mounts. It can be fabricated by extrusion, moulding or calendering.

A second nitrile silicone expected to be available next month is NSR-X8701, which is suggested for moulded parts such as O-rings, gaskets and oil seals immersed continuously at high temperatures. A third nitrile silicone rubber, NSR-X4803, available from April next, is stated to have intermediate resistance to high-temperature fluids.

Socony Mobil's Petrochemical Plans

Latest U.S. company to enter the petrochemicals field is the Magnolia Petroleum affiliate of Socony Mobil. It is to begin construction immediately of a $25 million-plus first stage which is expected to be on stream 1 January 1961. Capacity will be 380 million lb. a year of ethylene (over 99.8% purity) plus propylene (up to 85% purity) and some butadiene. M. W. Kellogg are to handle construction.

Cyanamid of Canada's Ammonia Plant to Use Methane

Cyanamid of Canada Ltd., Niagara Falls, will within 12 months be the largest user of natural gas for industrial purposes in Eastern Canada. The company makes ammonia and ammonium nitrate, using about 100,000 tons of coal annually imported from the U.S. But a $5 million conversion programme, to be completed in about a year, will replace the coal with natural gas as a basic material in ammonia making.

Dow Chemical move into Western Canada

Dow Chemical of Canada Ltd. have plans for what could be a string of new plants in Alberta. The first will produce caustic soda and chlorine from salt beds in the Fort Saskatchewan area. It is understood it will be a multi-million dollar operation. An option on 675 acres of land in two parcels has been taken up at Fort Saskatchewan.

According to the company, other products under consideration for Western Canada are hydrochloric acid, glycols, and plastic foam.

At present, Dow Chemical have no production in Western Canada, but speculation for some time has suggested that they would attach themselves to the big and growing petrochemical base there. While the first plant will use salt as its raw material, construction of new petrochemical plants by the company now seems assured.

Sulphuric Plant for Pernis

Albatross Superfosfaat fabrieken N.V. of Utrecht, Netherlands, is founding a new company in which Cyprus Mines Corporation of Los Angeles will participate. According to the report the company will erect at Pernis, near Rotterdam, 'one of the largest and best equipped sulphuric acid plants in Europe.' It will also produce and market chemical products. C.M.C.'s flotation pyrites will be the raw material for acid.

C-oil, New Esso Resin for Plastics

New resin developed by Esso Research and Engineering, Linden, New Jersey, U.S., and available in development quantities from Enjay Co., New York, is C-oil. The product is a liquid copolymer of butadiene and styrene in about an 80/20 weight ratio. It can be cross-linked, it is stated, with monomers such as styrene, vinyl toluene, diallyl phthalate, or fumarate esters to form rigid polymers.

Advantages claimed for C-oil are: low specific gravity (about 0.9 g./cc.), good water and chemical resistance and outstanding electrical properties.

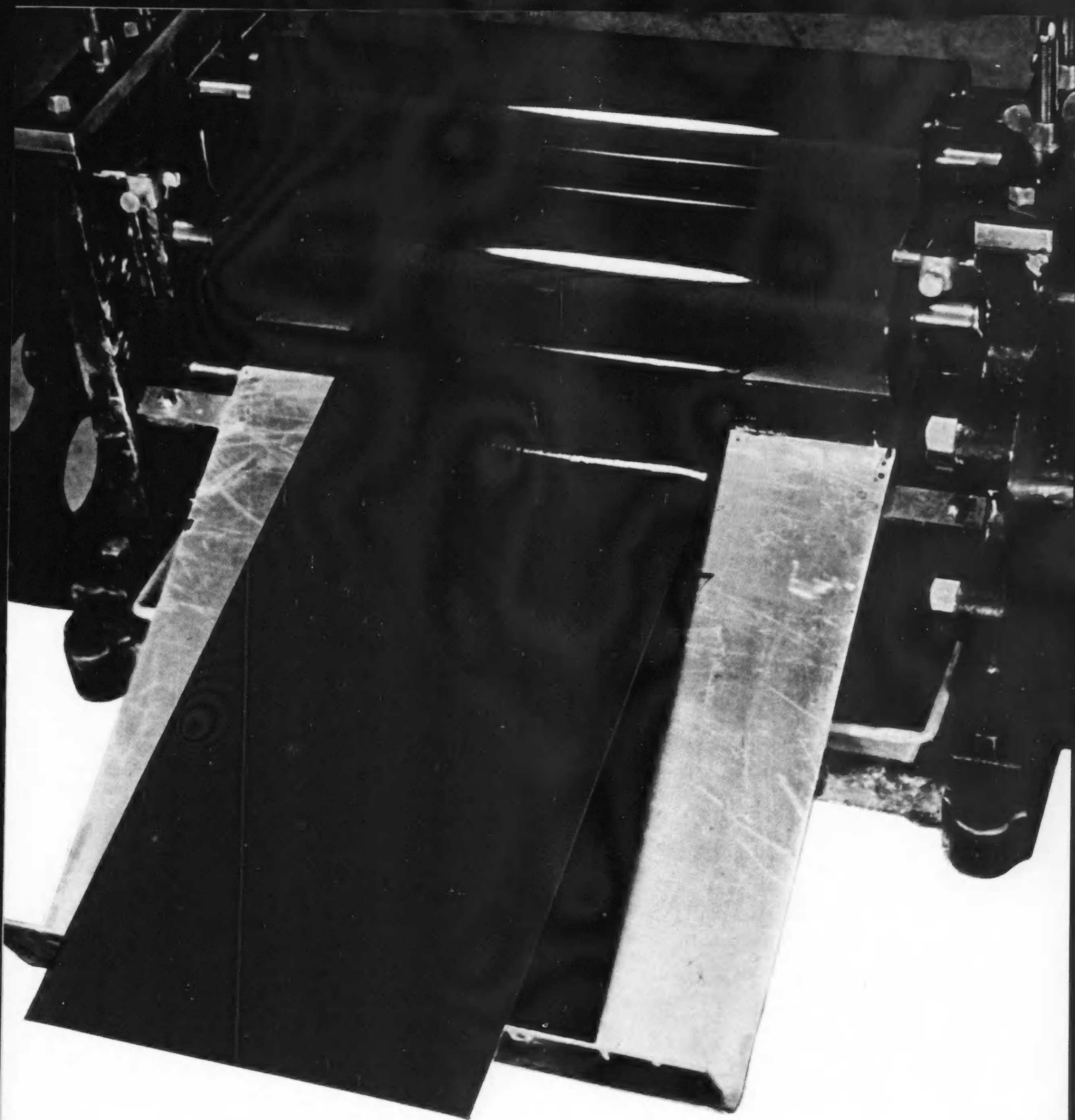
Continuous Arsine Monitor Leads to Safe-working with Arsenic Materials

SAFE working with arsenic-containing materials is no longer a problem for Texas Instruments, Dallas, U.S. Maurice Bran of the company's materials research department has developed a continuous arsenic monitor. A pump draws air at the rate of 400 c.c. per minute into a hydrogen generator where arsenic compounds present react with hydrogen to form arsine. The generator contains zinc chunks and sulphuric acid delivered from an acid reservoir (enough for eight hours' operation) above the generator.

Arsine passes through a scrubber where hydrogen sulphide is removed (since hydrogen sulphide interferes with the reagents detection of arsine). The scrubber contains filter paper strips impregnated with lead acetate. From this scrubber arsine passes through a fritted-glass impinger into the detection chamber. The impinger disperses the gas as small bubbles through the reagent—a pyridine solution of silver diethyldithiocarbamate—which changes from pale yellow to various shades of red in the presence of arsine. This reagent, Texas Instruments claim, will detect as little as 5 micrograms of arsenic as arsine. The reagent is contained in a reservoir and there is a container for waste reagent.

A colorimeter monitors the detection chamber. On the reagent changing colour, the colorimeter senses this and actuates a relay, which in turn trips an alarm bell. At 30-minute intervals a timer opens a solenoid valve which allows spent reagent to drain into the waste container. Another solenoid valve opens, permitting fresh reagent to enter the detection chamber.

A prototype commercial model is under construction by the company.



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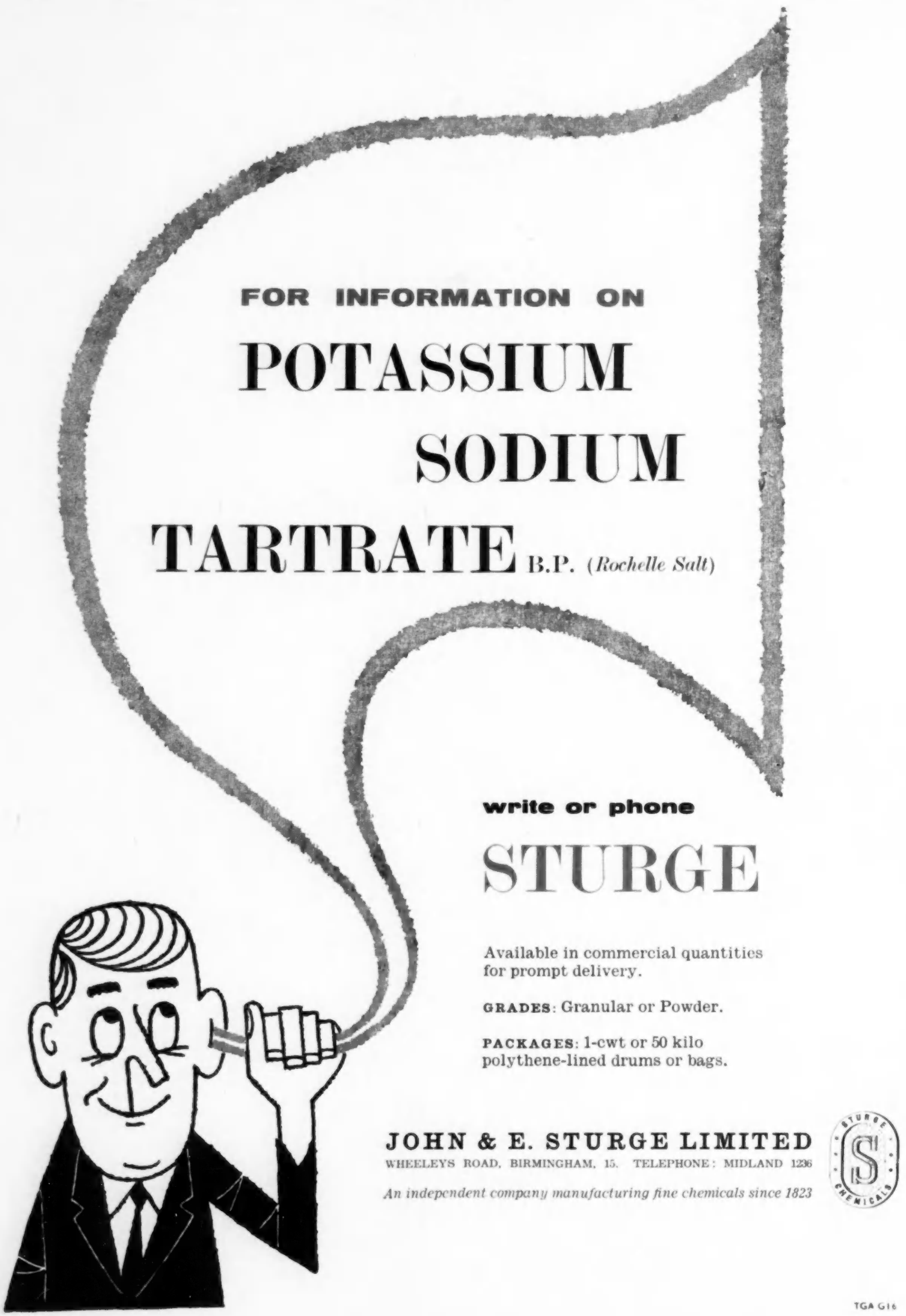
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TRADE NOTES

Non-ionic Surfactants

'Nonex Non-ionic Surface Active Agents', a new booklet published by Union Carbide Ltd., 103 Mount Street, London W.1, contains a full description of the general principles of non-ionic surface activity and the general properties and uses of the Nonex range which is produced by the company's Chemicals Division at Kirkby Works. The uses are grouped under various industries and typical formulations are given.

Mineral Plant Contract Disposal

Whole of the mining and mineral dressing equipment of Gambian Minerals Ltd., which was installed new in Gambia in 1955, is now being disposed of by George Cohen Sons and Co. Ltd., Wood Lane, London W.12. Included are rotary dryers, pumps, bulk loading plant, belt conveyors, elevators, storage tanks and hoppers, conveyor weighing machines, mineral separation plant, etc.

Pye Argon Chromatograph

A series of lectures and demonstrations has been arranged by W. G. Pye and Co. Ltd., Cambridge, for their argon chromatograph. Dates of those still to be held are: Edinburgh, 23 and 24 March, organised with A. R. Bolton and Co.; Glasgow, 25 March, organised with A. R. Bolton and Co.; London, 8 and 9 April. Mr. R. S. Evans will give the lectures and demonstrations. Admission is by invitation and those interested should apply to the company or the agents concerned.

Change of Address

From Monday, 23 March, the London office of Rocol Ltd., manufacturers of a wide range of molybdenum disulphide, etc., will be at General Buildings, Aldwych, London W.C.2 (Holborn 1985).

How Silicone Rubber is Used

Latest publication to be issued by Midland Silicones Ltd., 68 Knightsbridge, London S.W.1, 'Properties and Applications of Silastomer Silicone Rubber' gives some idea of the wide variety of uses to which silicon rubber is now being put in many industries. An interesting specialised application referred to is the specification by designers of atomic energy power stations of Silastomer for resilient seals on carbon dioxide-based heat-transfer systems. Further sections of the booklet deal with the resistance of Silastomer to extremes of temperature; chemical inertness; electrical insulating properties.

Two New Grades of Kieselguhr

Two new grades of German kieselguhr, now available for specialised filtration applications, are being distributed by Charles H. Windschuegl Ltd., 1 Leadenhall Street, London E.C.3. '80 special' kieselguhr is a high quality grade with a good white colour and large bulk volume. Made up of carefully selected and balanced diatoms all within the size range of 30-90 microns, it is primarily devised for the brewing and other trades requiring a chemically inert product which will give a good clarity of filtrate without loss of speed. '80 quick' kieselguhr is slightly off-white and gives a fast filtration rate with medium clarification. It is specially recommended for applications where build-up of back pressure is to be delayed and when highly viscous liquids, such as heavy oils, sugar syrup, are involved.

Five improved grades of kieselguhr, introduced by Windschuegl in 1957, have all been further improved in colour and bulk density during the past few months. From the 80 range of six grades it is now possible to select a grade of kieselguhr suitable for any filtration problem. Complementary to this range is '70 S. new,' which, slightly off-white in colour, is a cheaper general purpose powder with less volume than the 80s.

Reconditioned Jerricans

The Jerrican Division of J. E. Lesser and Sons Ltd., Green Lane, Hounslow, Middx, has formed an associate company to process and market reconditioned jerricans in large numbers in the U.K. and abroad. The new company, Reconditioners Ltd., will operate from the same address, and will also handle the aluminium jerrican pourer recently introduced by Lessers. Reconditioners Ltd. claim that their works at Verwood in Dorset, is the largest jerrican reconditioning plant of its kind in the U.K.

Glycerine Data Sheet

A new data sheet giving a useful summary of the physical properties of glycerine including short tables showing specific gravity, freezing points and vapour pressure/relative humidity data for different concentrations of glycerine in water, is available from the United Kingdom Glycerine Producers Association Ltd., 5 Bridewell Place, London E.C.4. It also describes the three principle grades of refined glycerine namely: 'chemically pure' for food preparations, drugs, cosmetics and toilet preparations; 'technical grade' (suitable for most industrial uses including paper, alkyd resins, adhesives, dyestuffs, etc.); and 'dynamite grade' (refined specifically for use in explosives).

Processed P.T.F.E. Price Cut

Permali Ltd., Bristol Road, Gloucester, have reduced the price of their Permaflon p.t.f.e. by an average of 10%. This reduction passes on to the customer the benefits of recent lower raw material costs as well as the production economies resulting from increased output and improved processing techniques. An example of this price cut is that ½-in. thick flat sheet, size 12 in. by 12 in., will now cost £9 9s instead of £10 10s.

New Plant for Dohm

To meet increased demand for Dohmfrac pre-coated resin sand for shell moulding and shell core production, a third manufacturing plant is now in full production at the Burslem, Stoke-on-Trent, works of Mellor Mineral Mills, one of the Dohm group.

New Quarterly on 'Nitrogen' by British Sulphur Corporation

British Sulphur Corporation Ltd., Fison House, 95 Wigmore Street, London W.1, are now publishing *Nitrogen*, a quarterly publication (annual subscription 10 guineas), which in its format, contents and style, closely follows the corporation's pioneer publication, *Sulphur*.

Aim of *Nitrogen* is to report and comment on the nitrogen industry from the varying aspects of production, technology, fertiliser and technical nitrogen usage, distribution, marketing, company affairs, etc. In the first issue, the present-day status of the nitrogen industry is reviewed.

Market Reports

PRICES AND TRADE REMAIN STEADY

LONDON Markets have shown little change on the week either as regards prices or conditions. Industrial chemicals are meeting with a steady demand on both home and export account, and the movement of supplies against contracts has covered good quantities. The improved demand for fertilisers has been sustained.

Business in coal-tar products is quietly steady with cresylic acid and pitch fairly active on home demand and for shipment.

MANCHESTER Apart from bleaching, dyeing and finishing chemicals, the demand for which is mostly at a reduced level, there has been a fairly steady call for contract deliveries on the Manchester market. A moderate flow of new inquiries has also been reported and shipping business has been maintained on a satisfactory scale. There has been little change of any consequence in the general price position, a steady to firm undertone being reported. Current reports in the fertiliser section point to a continued steady seasonal demand for a number of lines, including sulphate of ammonia and other nitrogeneous materials.

GLASGOW The past week was one of reasonable activity in the Scottish heavy chemical market, with an improvement being shown in certain sections. Quantities were steady, and at the same time covered a varied range of chemicals. Contract requirements were also fairly well maintained. Prices on the whole showed a tendency to firmness.

Interest in agricultural chemicals is now considerably increased, and a number of inquiries are being made, with bookings for forward requirements. There is little change in the export market.

Commercial News

• I.C.I. to Raise Nylon Capacity for B.N.S.
• Steetley to Exploit New Dolomite Quarry
• Du Pont Report End-1958 Sales Recovery
• Nickel Sales Outlook is More Encouraging

Bakelite Ltd.

Group profits of Bakelite Ltd. increased from £431,022 to £538,458 in 1958 and the dividend is repeated at 15% with a final of 10%. The balance is after provision of £271,378 (£239,747) for depreciation and £16,703 for scientific research (£19,479 and special obsolescence £17,712) and includes unrequired provisions of £16,703 (£37,191). Debenture interest requires £48,519 (£49,350) and tax £250,609 (£156,200), leaving a net profit of £239,330, against £225,472.

Borax (Holdings)

Main difficulties in starting up Borax Holdings' U.S. subsidiary company's plant at Boron, U.S., were reported by the chairman, Lord Clitheroe, at the shareholders' meeting, as having been overcome. It was a very large new plant which had cost over $20 million and was the first of its kind in the world. There were still some problems to solve, but when these were overcome it was expected that the U.S. company would make even more satisfactory profits than at present.

In reply to a shareholder who asked what proportion their potash activities bore to their borax activities, Lord Clitheroe said that roughly two-thirds of their whole business was in borax and one third in potash.

British Nylon Spinners

A fall from £9,619,448 to £4,879,158 in consolidated profits for 1958 is reported by British Nylon Spinners, jointly owned by I.C.I. and Courtaulds. The balance was struck after £1,376,696, against £992,733 for depreciation and nil (£500,000) to fixed assets replacement reserve. Taxation took £2.7 million (£5.4 million) leaving a net profit of £2,970,054 (£4,699,233).

Expenditure on fixed assets during the year amounted to £4.4 million. Revaluation of fixed assets at 1 January 1958 resulted in an increase in the net book value of £7,052,551. During the year a part of the liquid funds was loaned free of interest, in equal proportions to I.C.I. and Courtaulds. These loans totalled £4,603,500. Profits for 1959 are expected to show some recovery, although costs are expected to continue to rise.

Plans for a further expansion of capacity by purchase of a factory at Gloucester have been announced.

Arrangements are under consideration with I.C.I. for an extension of their capacity at Wilton to provide the additional polymer required.

Cambridge Instruments

Trading profit of Cambridge Instruments for 1958 is £474,389 (£564,170) and net trading profit £413,749 (£196,383). Profit after tax is £216,515 (£222,152). The sum of £10,000 has been put against buildings and plant. Capital commitments total £130,000.

Final ordinary dividend on capital increased by one-for-two scrip issue is 1¼% (1⅞%) making 16¼% (16⅞%) tax free with a 15% interim (same) on old capital.

Newton Chambers

Chemical manufacturers, iron founders and engineers, Newton Chambers and Co., had a group profit of £896,573 for 1958 compared with £805,855 in 1957. The 1957 figure does not include the results of Ransomes and Rapier acquired in 1958.

The company is maintaining its 16% total dividend for 1958, with an unchanged 10% final.

Steetley Co.

The Steetley Co. are to exploit a new dolomite quarry and will build a processing plant at Whitwell at a capital cost of £1.6 million. The new works are expected to start operating early next year. This was stated by Mr. N. M. Peech, chairman, in his annual report. Capital spending during 1958 on plant and mineral investment amounted to £1,086,000, consisting mainly of final payment of bills in respect of works' extensions completed at the end of 1957.

Europa Chemie

Europa Chemie is a new Swiss investment trust placing its funds in European chemical industries. Activities of the trust are not confined to activities in the Common Market area. Of the official portfolio, worth about 10 million Sw. francs, 10% is in British chemical stock, according to the prospectus.

E.I. du Pont de Nemours

Sales of the Du Pont Co., U.S., in 1958 were $1,829 million, down 7% on 1957. In the final three months of the year sales were a record for any quarter. Net earnings from operations were 20% less than in 1957 while average operating investment was 7% higher. As a result, the percentage return on operating investment declined from 11% in 1957 to 8.2%.

In 1958, the average weekly wage was 71% above the 1947-49 average, a rate of increase of 5¼% a year, which more than offset advances in technology arising from research and development activities during the period. During the year said Mr. C. H. Greenewalt, president, Du Pont witnessed the anomalous combination of an increase in wages and salaries and a substantial decrease in the general level of business. It was inevitable that profit margins would decline more rapidly than ordinarily would have been expected from the reduced volume of operations.

Du Pont spent the record sum of $231 million in 1958 for new plants, increased capacities at existing plants, and for service and laboratory facilities, compared with $220 million in 1957. In 1958, the average gross operating investment increased $160 million to a total of $2,581 million. Four new plants were completed and began operations during the year. These were for the production of pure silicon, Orlon acrylic staple, cellulose film and nylon tyre cord. Among other products for which substantial projects were undertaken were: Dacron polyester fibre, titanium pigments, Delrin acetal resin, sodium, neoprene, anhydrous ammonia, Teflon fluorocarbon resins, Alathon polythene resin, graphic arts films, and Butacite polyvinyl butyral sheeting.

The company spent $90 million for research and development during 1958, exclusive of laboratory construction.

Inco

International Nickel Company of Canada's net earnings fell from $(U.S.) 20.1 million to $9.3 million in the last quarter of 1958, making the year's total £39.7 million, against $86.1 million in 1957.

According to chairman, Dr. J. F. Thompson, and president, H. S. Wingate, the outlook for increased nickel sales is more encouraging than at any time since the end of 1957. In 1958, Inco did not operate at capacity. Deliveries of nickel amounted to 205.8 million lb. (290.1 million). Consumption, against free world production of 525 million lb., amounted to some 320 million lb. or 95 million lb. below the previous year's record consumption.

Hercules Powder

Turnover of Hercules Powder Co. Inc., Wilmington, Delaware, fell 4% in 1958, the previous year being the peak sales year of the company; 1958 net turnover was $236,500,000. Although the profit per share fell accordingly—by 5%—the same share dividend of 52.5% was paid. Productivity was improved considerably over the year. The current year is expected to show better results than 1958.

I.C.I. A.N.Z.

£A3 million is to be raised by Imperial Chemical Industries of Australia and New Zealand for general expansion of manufacturing facilities by an issue of unsecured notes at 7%.

NEW COMPANY

Plastics Development and Applications Ltd. Cap. £120,000. To take over Lucent Products Ltd. and Structoplast Ltd., etc. Directors: Clive V. Callman, Douglas B. Law, John M. Weiner, and Victor E. Yarsley. Reg. office: Oaklands, Clayton Road, Chessington.

NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATIONS

On sale 22 April

New colouring matters of anthraquinone series and process of colouring therewith. Imperial Chemical Industries Ltd. **787 284**

Composition for temporarily sterilising soil. Stauffer Chemical Co. **789 690**

ACCEPTANCES

Open to public inspection 29 April

Recovery of ruthenium. Grummitt, W. E., and Hardwick, W. H. **812 682**

Means for signalling the passage or otherwise of coal or other material through a shoot or the like. Clarke, Chapman & Co. Ltd., and Woodeson, J. B. [Cognate application 16 071.] **812 545**

Composition and process for bleaching, disinfection and cleaning materials. Zakarias, J., and Zakarias, Dr. L. **812 627**

Recovery of uranium from solutions. Permutit Co., Ltd. **812 815**

Process for producing a technically pure soda. Baumann, F. **812 795**

Halogen-testanes and process for their manufacture. Ciba Ltd. **812 690**

Electrolytic production of titanium. Solar Aircraft Co. **812 817**

Extrusion or other high pressure flow-working of titanium. National Research Development Corp. **812 819**

Processes for production of extremely pure substances. Siemens & Halske A.G. **812 818**

Synthesis of steroids. Olin Mathieson Chemical Corp. **812 810**

Production of N, N-dibenzylamino acids. Uclaf. **812 541**

N-benzylpeptides and process for their production. Uslaf. **812 542**

α-Amino acids and peptides derived therefrom. Uclaf. **812 543**

Elastomers. Goodrich Co., B. F. **812 613**

Ethylene polymerisation. Imperial Chemical Industries Ltd. **812 602**

Simultaneous extrusion and foaming of plastics materials. Du Pont de Nemours & Co., E. I. **812 798**

Elastomer compositions. Goodrich Co., B. F. **812 614**

Treatment of textiles. Laporte Chemicals Ltd. **812 752**

Production of radioactive phosphorus. Institutt for Atomenergi. **812 701**

Method and apparatus for the continuous production of metallic beryllium. Beryllium Corp. **812 702**

Quaternary tropanol-3 derivatives. Smith Ltd., T. & H., Johnston, R. G., and Spencer, K. E. V. [Cognate specifications 24 640 and 35 683.] **812 705**

Method of operating a direct gas cooler. Koppers G.m.b.H., H. **812 706**

Process and apparatus for comminuting solid synthetic resinous material. Imperial Chemical Industries Ltd. **812 759**

Methods of making microporous material. United States Rubber Co. **812 564**

Gas analysing apparatus. Cambridge Instrument Co. Ltd. **812 714**

Production of elemental and phosphorus ferrous chloride. Pennsylvannia Salt Manufacturing Co. **812 801**

Material having oil-retaining properties. Fluidwick Co. Inc. **812 570**

Production of hot-pressing quality naphthalene. Rheinelbe Bergbau A.G., and Koppers G.m.b.H., H. **812 725**

Ultra-violet absorbing filters. General Aniline & Film Corp. **812 726**

Sweetening compositions and method for making same. Abbott Labs. **812 575**

Glass composition. Pittsburgh Plate Glass Co. **812 576**

Process for the preparation of pseudo isomethyl ionine and the isomethyl ionones. Polak & Schwarz's Essence-Fabricken N.V. **812 727**

Method of producing viscose rayon stable fibres with a particularly high degree of crimping. Spinnfaser A.G. **812 728**

Production of gases. Hutchinson, T. H. **812 616**

Portable water-distillation apparatus. Lea Bridge Industries Ltd. **812 804**

Process for curing compounds having internal epoxy groups. Bataafsche Petroleum Maatschappij N.V. **812 735**

Ferrous base alloys. Universe-Cyclops Steel Corp. **812 582**

Process for the production of acrylonitrile. Escambia Chemical Corp. **812 475**

Production of cobaltous hydroxide. Mond Nickel Co. Ltd. **812 476**

Protection of graphite against gas corrosion at elevated temperatures. British Thomson-Houston Co. Ltd. **812 740**

Purification of waste waters from petroleum hydrocarbon processing. Universal Oil Products Co. **812 648**

Thio- and dithio-carbonic acid esters. Farbenfabriken Bayer A.G. **812 480**

Process for preparing alkene nitriles. Stamicarbon N.V. **812 780**

Continuous leaching of boron ores. Treibacher Chemische Werke A.G. **812 486**

Compositions for removing corrosion products from metals. Jenolite Ltd. [Cognate application 7 805.] **812 745**

Composition for the control of fungus organisms. American Cyanamid Co. **812 492**

Salts of basic ethers of diphenyl ethinyl carbinols and the production thereof. Asta-Werke A.G. **812 493**

Cyclic phosphoric acid ester amides and the production thereof. Asta-Werke A.G. **812 651**

Purification of esters of acrylic and methacrylic acids. Union Carbide Corp. **812 498**

Method of preparing alkyl boron compounds. Kali-Chemie A.G. **812 787**

Device for separating solid or liquid particles from gases or vapours. Schmid, O. **812 501**

Production of dried aluminium hydroxide gels. Reheis Co. Inc. **812 503**

Titanate ester compositions and processes for imparting water-repellency. Monsanto Chemicals Ltd. [Addition to 804 989.] **812 505**

Method of converting gaseous hydrocarbons. Gerhold, M. **812 807**

Preparing cellulose ethers and the product obtained thereby. Dow Chemical Co. **812 510**

Production of solid sodium nitrite. Du Pont de Nemours & Co., E.I. **812 511**

Compositions for combating nematodes. Farbenfabriken Bayer A.G. **812 512**

Preparation of polybutadiene-styrene-acrylonitrile graft polymers. Union Carbide Corp. **812 808**

Polymerisation of ethylene. Soc. Des Usines Chimiques Rhone-Poulenc. **812 515**

Production of quaternary phosphonium halides. Badische Anilin- & Soda-Fabrik A.G. **812 522**

Durene dialdehyde and its preparation. Esso Research & Engineering Co. **812 526**

Manufacture of fibres from thermoplastic materials. Manufactures Des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey S.A., Des. **812 657**

Preparation of unsaturated polyester copolymers. Chemische Werke Hüls A.G. **812 675**

Phosphonic and thiophosphonic acid derivatives. Farbenfabriken Bayer A.G. **812 530**

Fumigant composition. Dow Chemical Co. **812 531**

Production of corrosion-resistant coatings on magnesium surfaces. Amchem Products, Inc. **812 665**

Isopropylidene bis (dichlorophenyleneoxy) dialkanols. United States Rubber Co. **812 534**

Union-dyeable fibre blends. Dow Chemical Co. **812 535**

Soil fumigant compositions. Dow Chemical Co. **812 677**

Process for recovering noble metals. Universal Oil Products Co. **812 679**

Separation of hydrocarbons with molecular sieves. Esso Research & Engineering Co. **812 680**

Process and apparatus for the continuous separation of gas mixtures by means of gas chromatography. Deutsche Erdöl-A.G. **812 538**

Open to public inspection 6 May

Gas detarring plant. Holmes & Co. Ltd., W. C., and Sykes, W. **812 907**

Degreasing and dewaxing of vegetable fibres. Imperial Chemical Industries Ltd. **812 894**

Cured natural or synthetic rubber compositions. United Aircraft Corp. **813 115**

Bismuth aluminate for treatment of diseases of the digestive tract and process for the manufacture thereof. Etablissements Roques. **812 918**

Apparatus for treating compressed fuel briquettes and materials of similar character. Houilleres du Bassin du Nord et du Pas-De-Calais. [Addition to 716 537 and 722 495.] **812 822**

Catalytic reforming. Socony Mobil Oil Co. Inc. **812 895**

Continuous bleaching of cellulosic textile materials. Imperial Chemical Industries Ltd. **812 893**

Monoazo-dyestuffs of the naphthylamine series and process for their manufacture. Ciba Ltd. **812 957**

Catalytic cracking of hydrocarbons. Socony Mobil Oil Co. Inc. **812 896**

Anthrone derivatives. Ciba Ltd. **812 825**

Reducing corrosion of metal parts. Magnesium Elektron Ltd. **813 048**

Manufacture of plates for lead-acid secondary batteries. Crompton Parkinson Ltd. **812 920**

Apparatus for bending sheet glass. Pittsburgh Plate Glass Co. **813 107**

Sentising dyes for photographic silver halide emulsions. Gevaert Photo-Producten N.V. **812 924**

Manufacture of low molecular carboxylic acid anhydrides. Knapsack-Griesheim A.G. **812 963**

Production of a hard metal coating of carbides on a ferrous mass. Titanium Products Corp. **813 120**

Aminoisoxazolidone compounds. Merck & Co. Inc. **812 830**

Method and apparatus for the deposition of metallic coats on rovings of glass fibre. Commonwealth Engineering Co. of Ohio. **812 930**

Method for continuous self-sustaining flameless oxidation of combustible materials. Sterling Drug Inc. **812 832**

Heat treatment of zirconium alloys. U.K. Atomic Energy Authority. **813 124**

Polymeric films. Du Pont de Nemours & Co., E. I. **812 972**

Process for preparing nitriles. Perfogit S.p.A. **812 974**

Petroleum fuels and other hydrocarbons. Imperial Chemical Industries Ltd. **812 938**

Polymerisable ester and polymers obtained therefrom. Imperial Chemical Industries Ltd. **812 983**

DIARY DATES

MONDAY 23 MARCH

Inst. Rubber Industry—Manchester: Grand Hotel, 6.45 p.m. 'Protection of rubber and some plastics against ageing and weathering', by Dr. W. McG. Morgan.

S.A.C.—Birmingham: Univ., 7 p.m. 'Some aspects of the analytical applications of chelate compounds', by Prof. H. Freiser.

S.C.I.—Leeds: Hotel Metropole, 6.30 p.m. A.G.M. 7 p.m., S.C.I. Jubilee Memorial Lecture, 'The "conveyor" concept of water in industry', by E. L. Streatfield.

TUESDAY 24 MARCH

S.C.I.—Birmingham: Birmingham and Midland Inst., 6.30 p.m. Two papers, 'Molecular weights of high polymers', by Dr. R. S. Lehrle and Dr. F. W. Peaker.

S.C.I.—London: Chem. Dept., Birkbeck Coll., W.C.1. Exhibition of laboratory techniques.

WEDNESDAY 25 MARCH

Oil and Colour Chem. Assn.—London: Roy. Soc. Trop. Med. and Hyg., Manson House, 26 Portland Pl., W.1, 7 p.m. 'Some recent advances in corrosion and protection fundamentals', by Dr. T. P. Hoar.

S.C.I. with R.I.C.—Falkirk: Lea Park Rooms, 7.30 p.m. 'Raw material development in Scotland', by Dr. R. H. S. Robertson.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6.15 p.m. 'Developments in the oil milling and animal feedingstuffs industry', by J. G. Collingwood.

THURSDAY 26 MARCH

C.S.—Bristol: Chemistry Dept., Univ., 6.30 p.m. A.G.M., followed by scientific films.

Inst. Metals—Sheffield: Univ., 7.30 p.m. 'The Nimonic alloys', by Dr. W. Betteridge.

Inst. Plant Engrs.—Sheffield: Grand Hotel, 7.30 p.m. 'Refractories', by T. R. Lynam.

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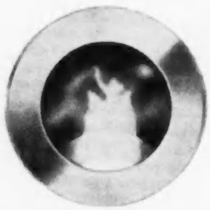

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